

## DONORS

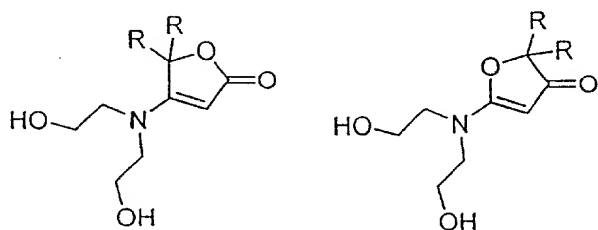
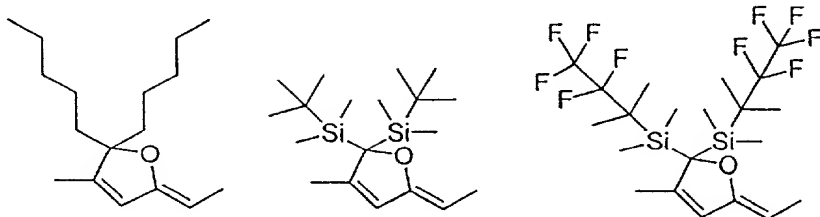


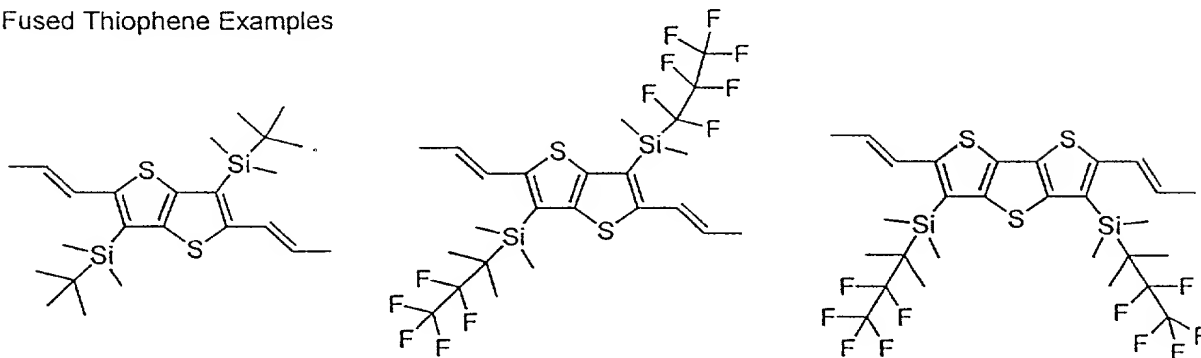
FIGURE 1

## BRIDGES

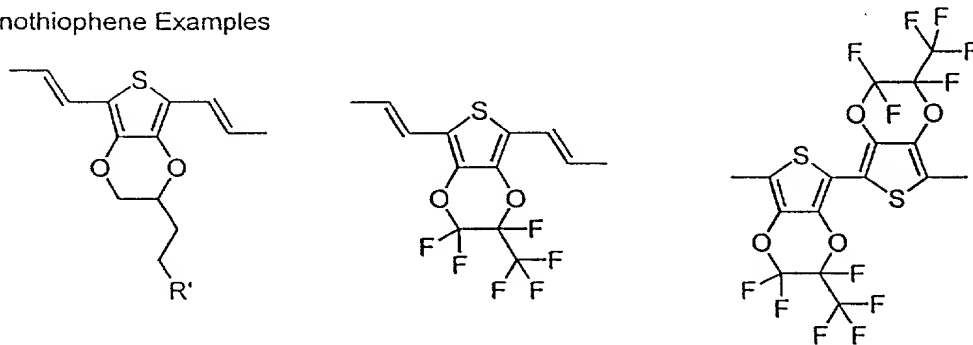
### 1. Polyene Examples



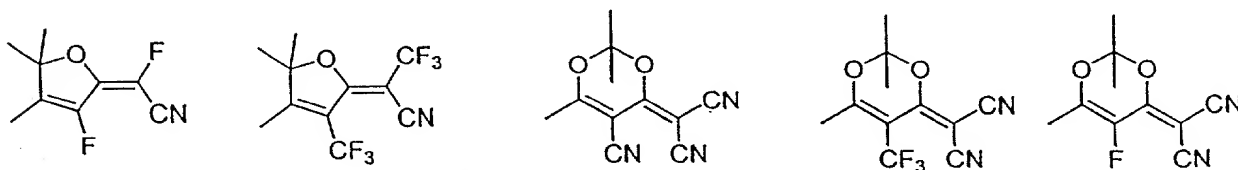
### 2. Fused Thiophene Examples



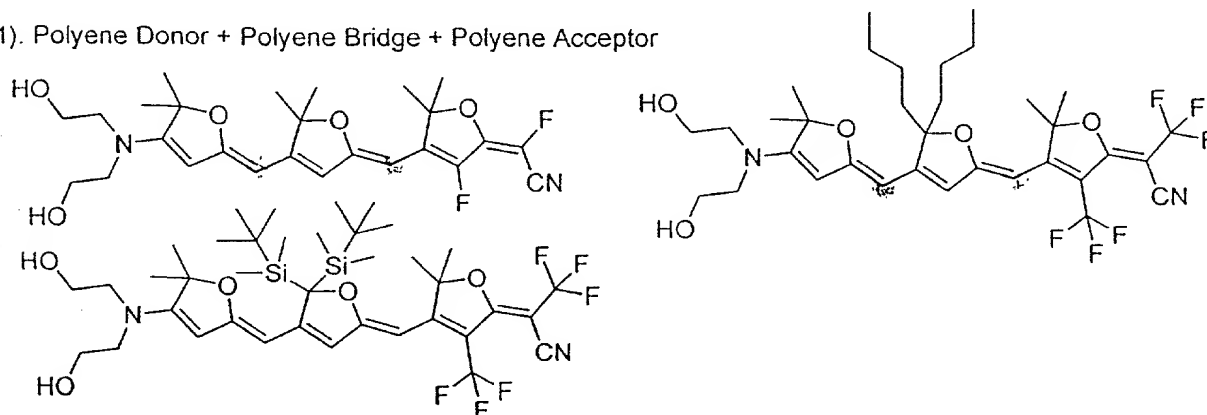
### 3. Monothiophene Examples



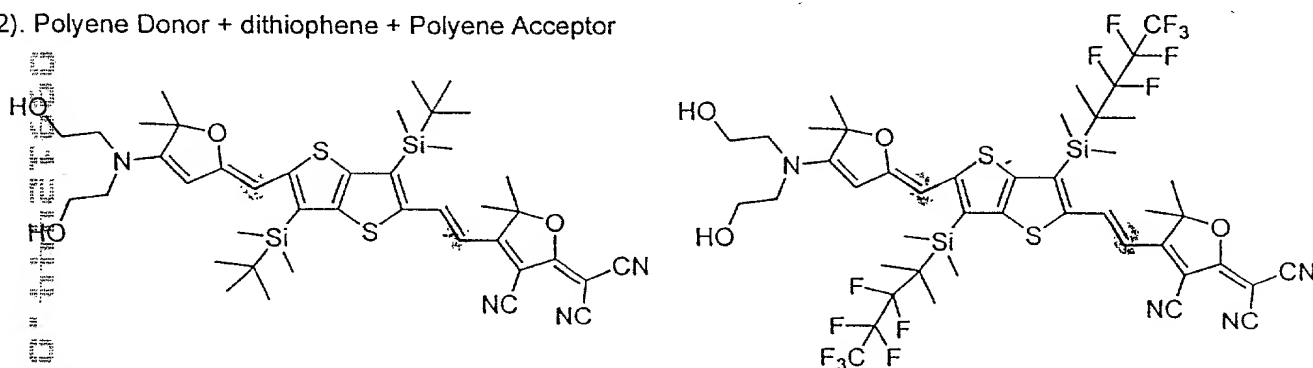
## ACCEPTORS



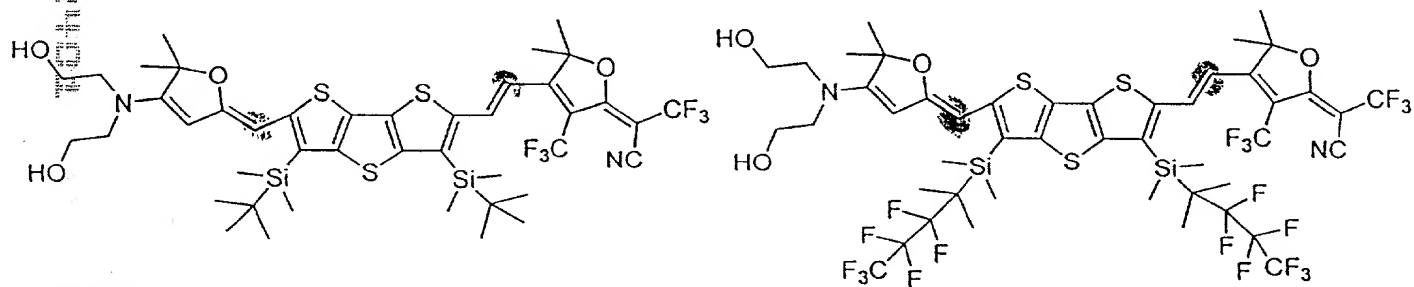
1). Polyene Donor + Polyene Bridge + Polyene Acceptor



2). Polyene Donor + dithiophene + Polyene Acceptor



3). Polyene Donor + tri-thiophene bridge + Polyene Acceptor



4). polyene Donor + thiophene + Polyene Acceptor

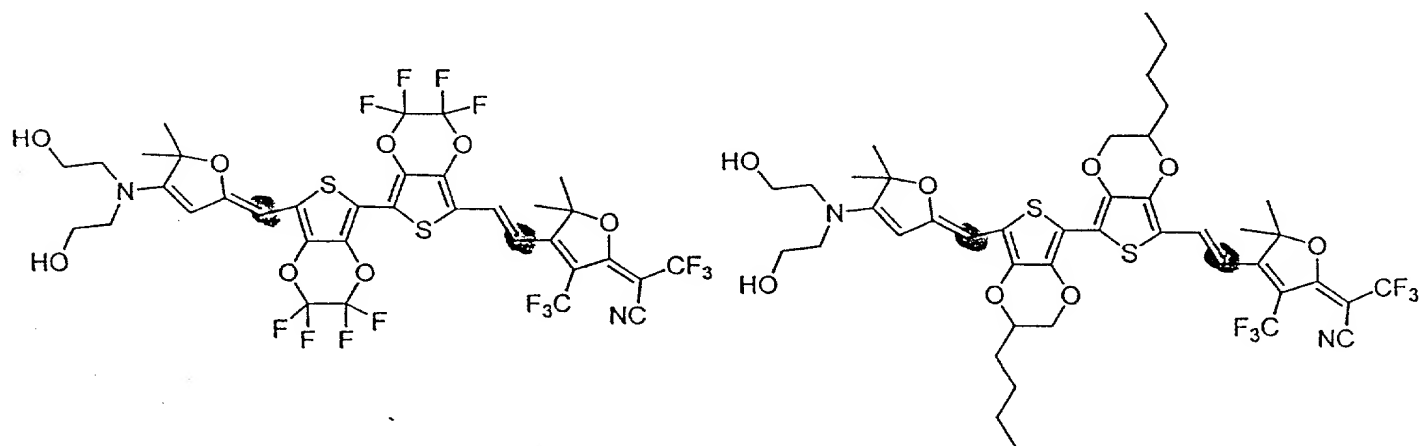


FIGURE 2

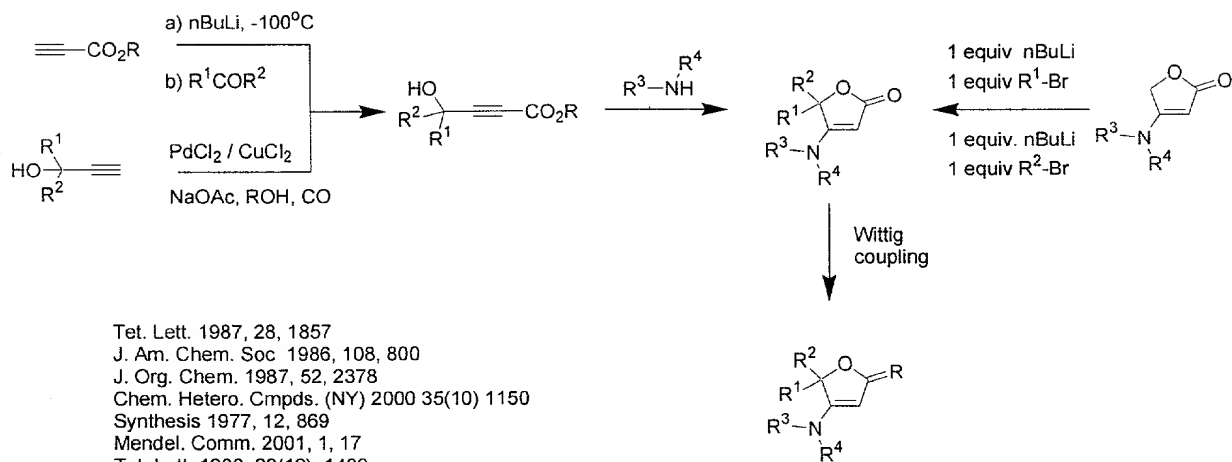
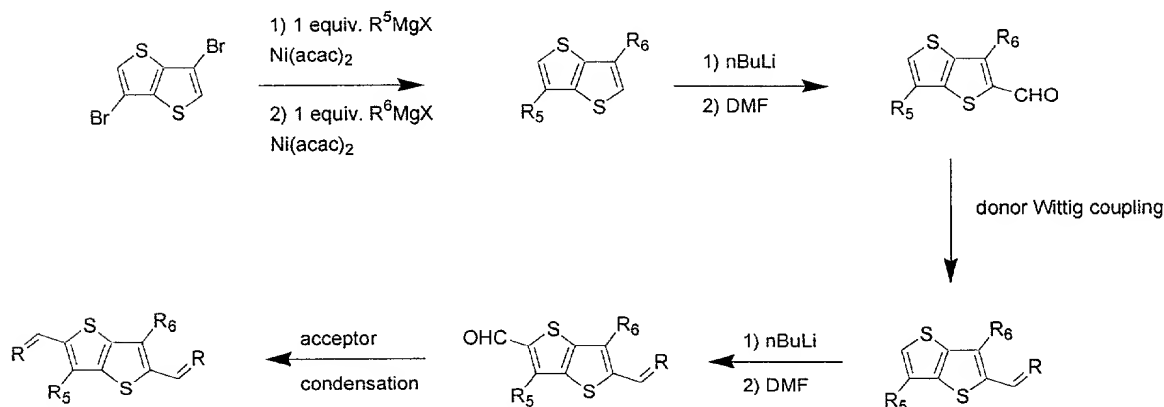
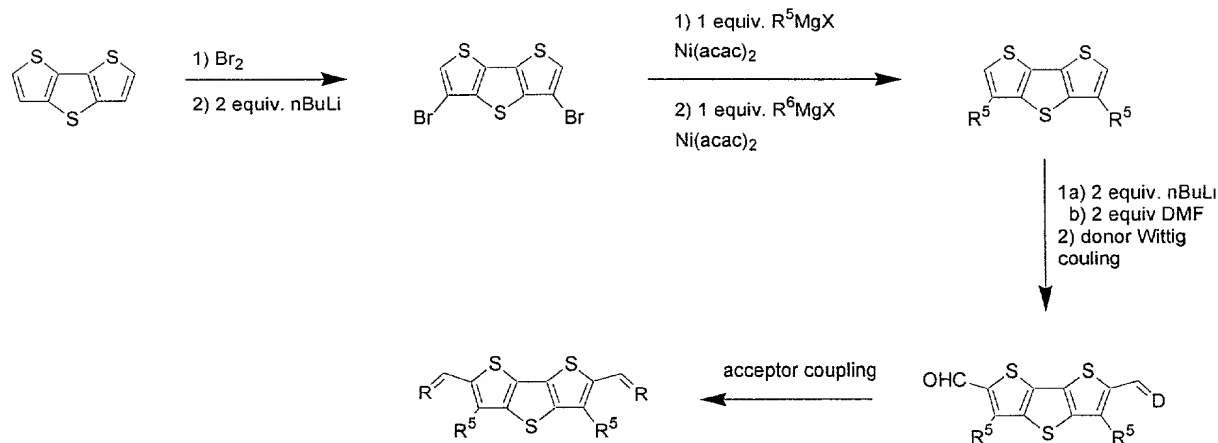


FIGURE 3



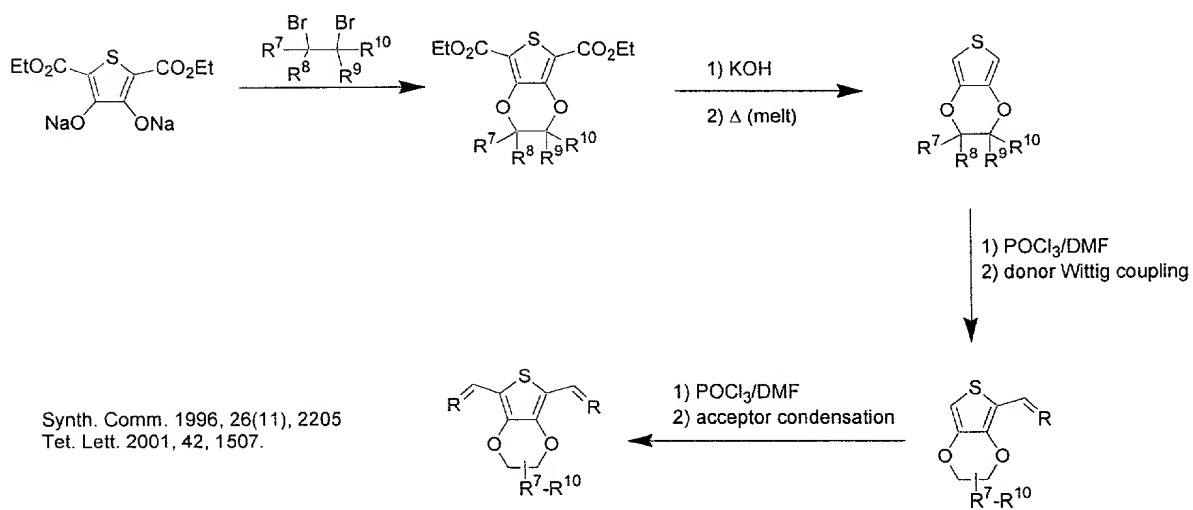
J. Chem. Soc. Perk. Trans. 1 1997, 22, 3465  
 Heterocycles 1994, 38(1), 143  
 J. Organomet. Chem. 1973, 50, C12  
 Pure Appl. Chem. 1980, 52, 669  
 Tet. Lett. 1981, 22, 4449

FIGURE 4



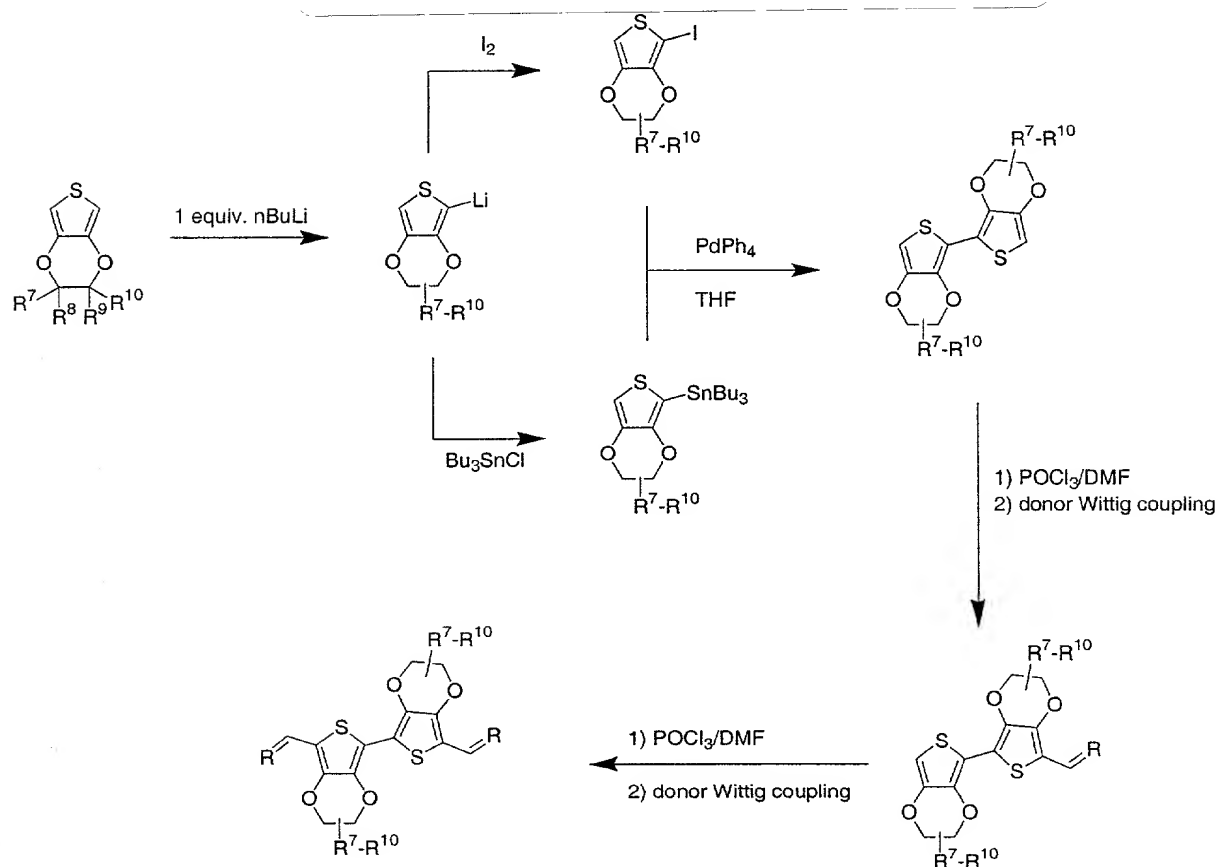
J. Org. Chem. 1971, 36(12), 1645  
 J. Chem. Soc. Perk. Trans. 2 1992, 5, 765  
 J. Mater. Chem. 1999, 9(9), 2227

FIGURE 5



Synth. Comm. 1996, 26(11), 2205  
 Tet. Lett. 2001, 42, 1507.

FIGURE 6



J. Am. Chem. Soc. 2001, 123(19), 4643  
 Chem. Mater. 1996, 8(11), 2659  
 J. Chem. Soc. Perkins Trans. I 1997, 1957

FIGURE 7

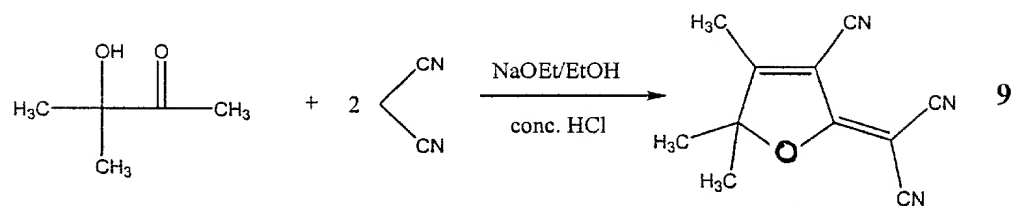


FIGURE 11

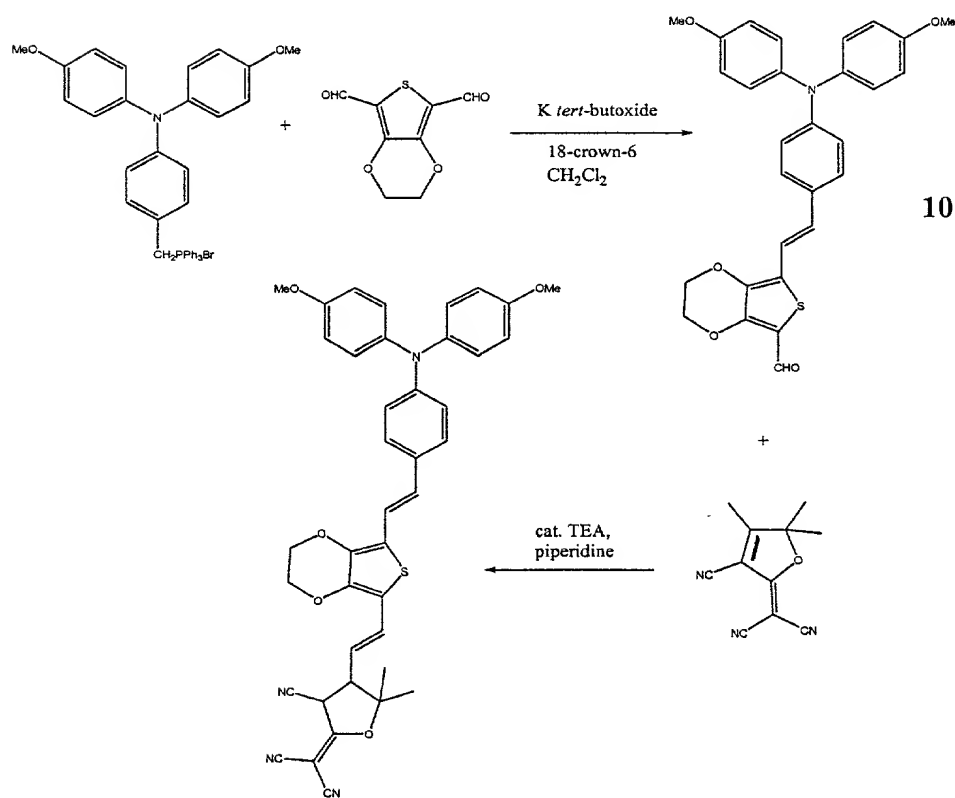


FIGURE 8

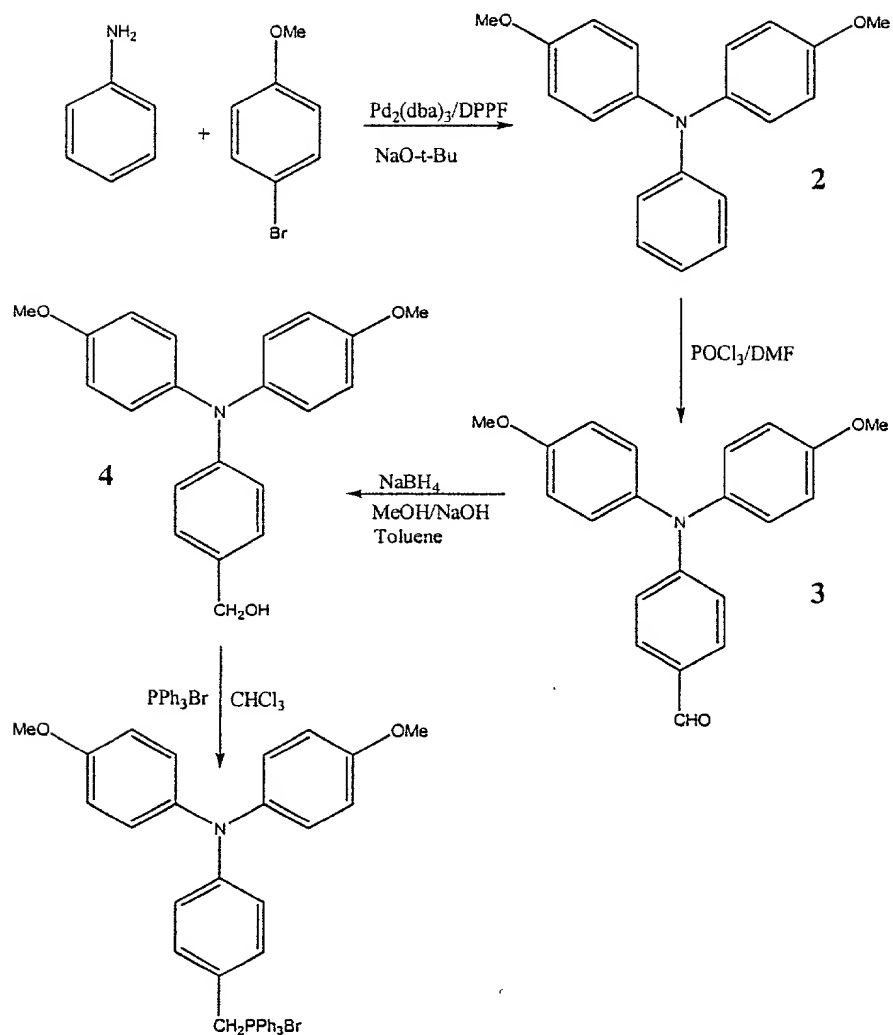


FIGURE 9

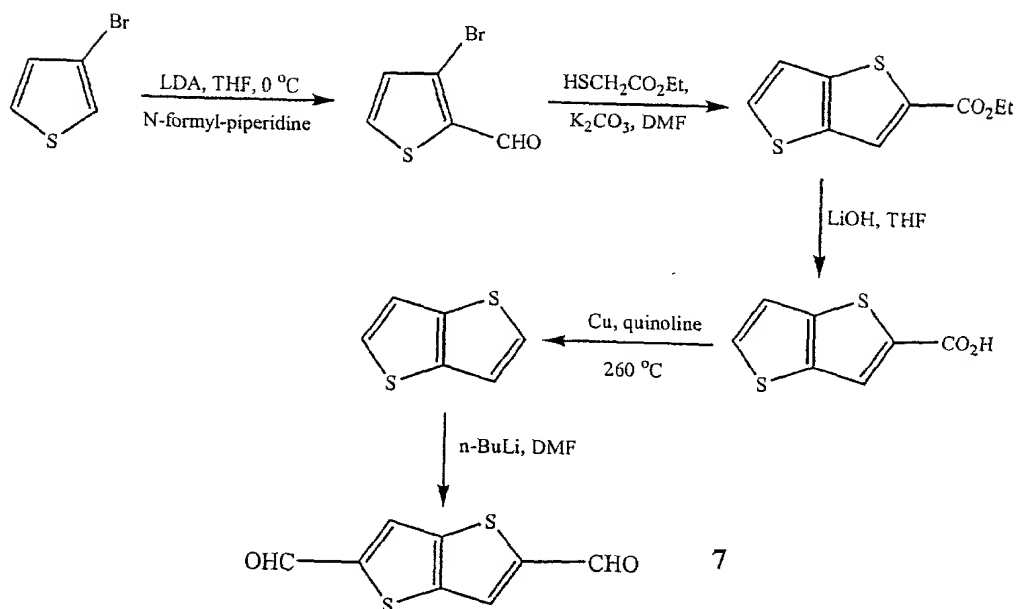


FIGURE 13

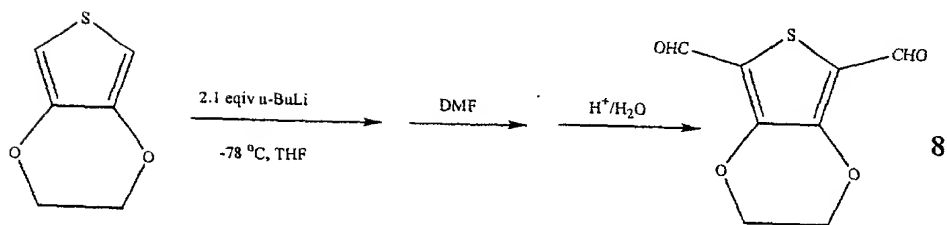


FIGURE 10



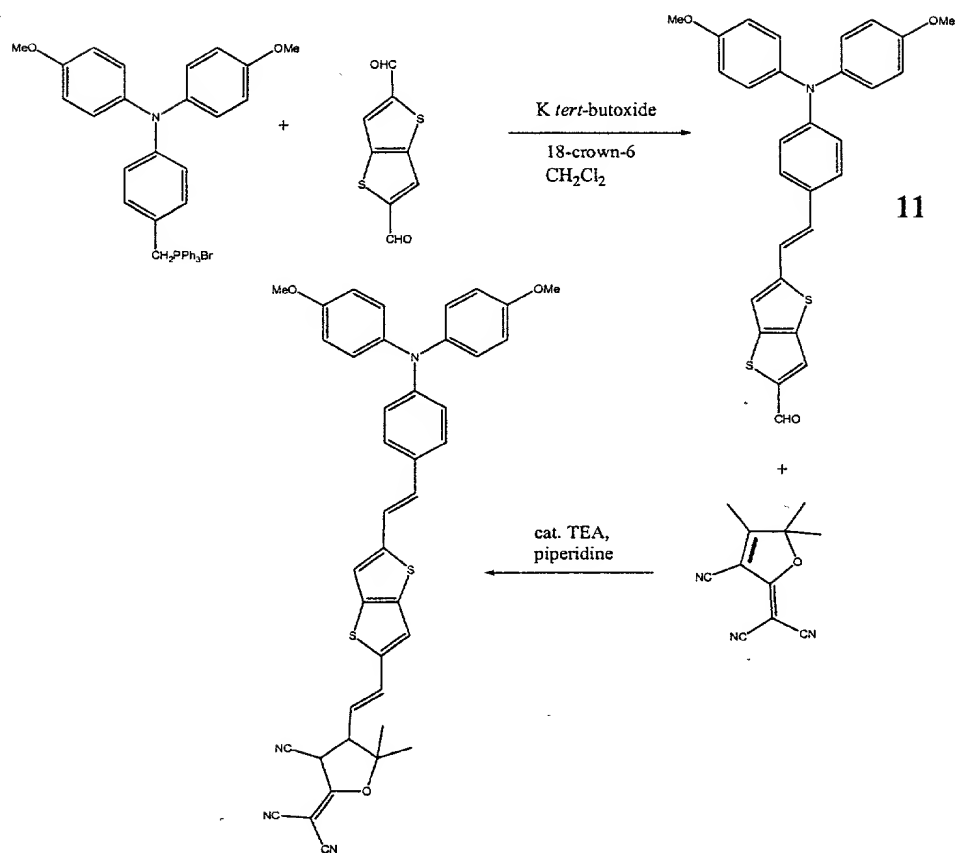


FIGURE 12

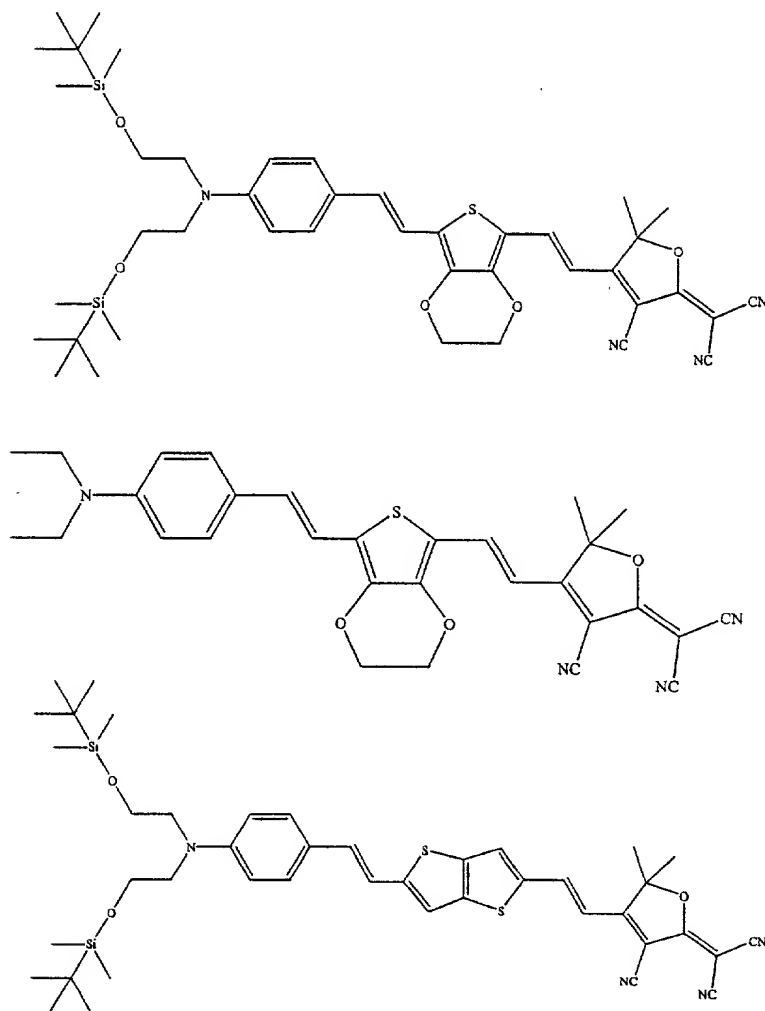


FIGURE 14

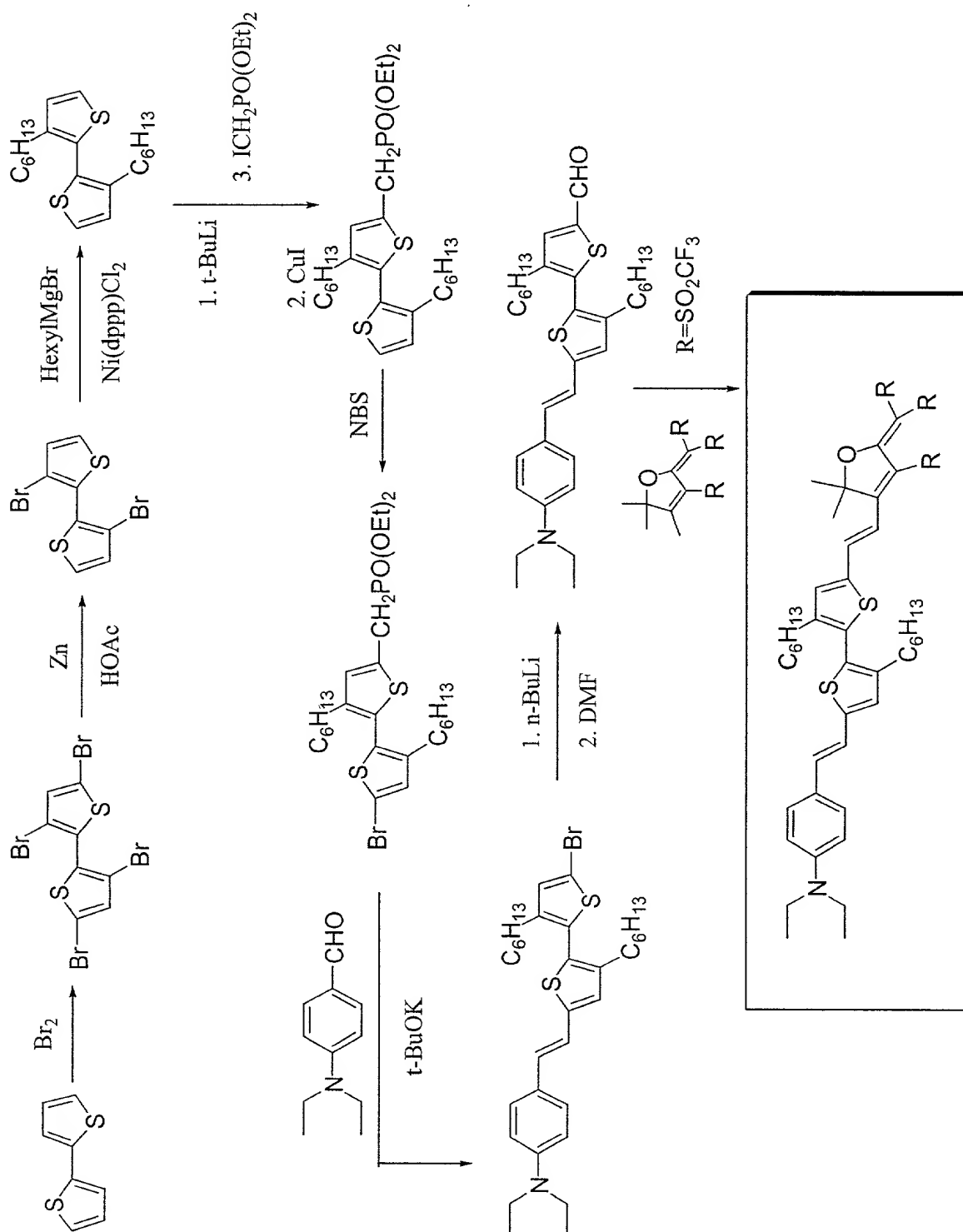


FIGURE 15

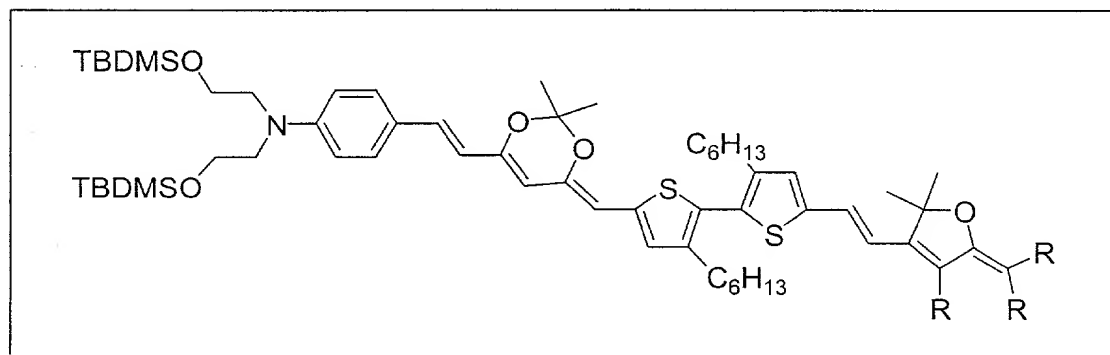
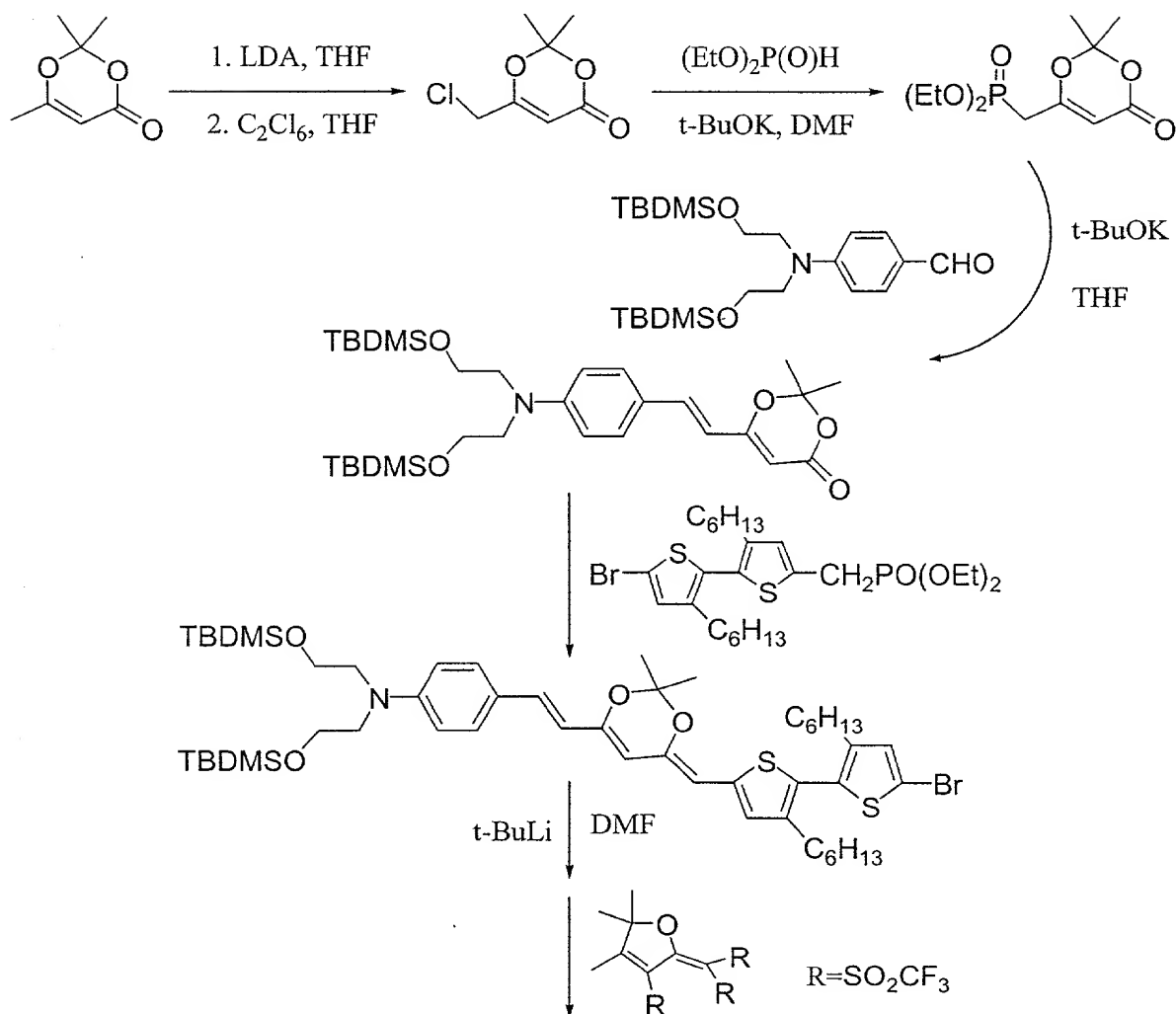


FIGURE 17

# EO coef. vs. chromophore loading

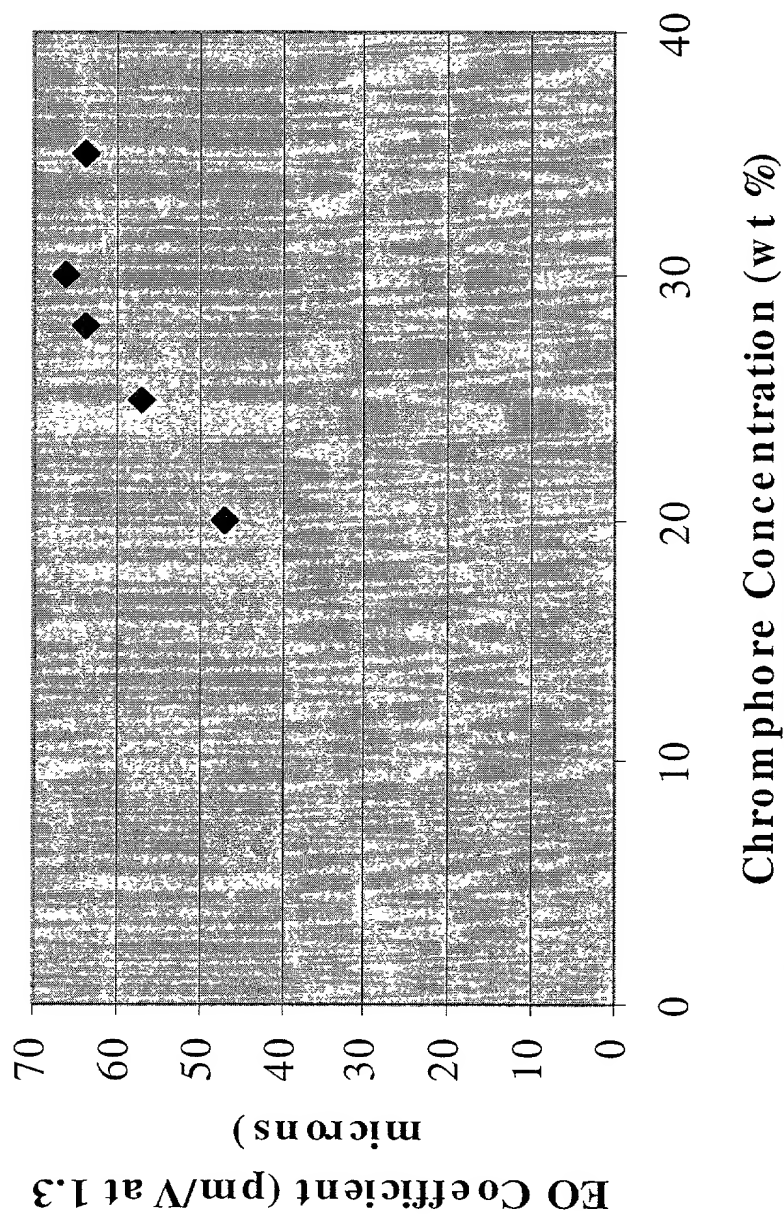


FIGURE 18

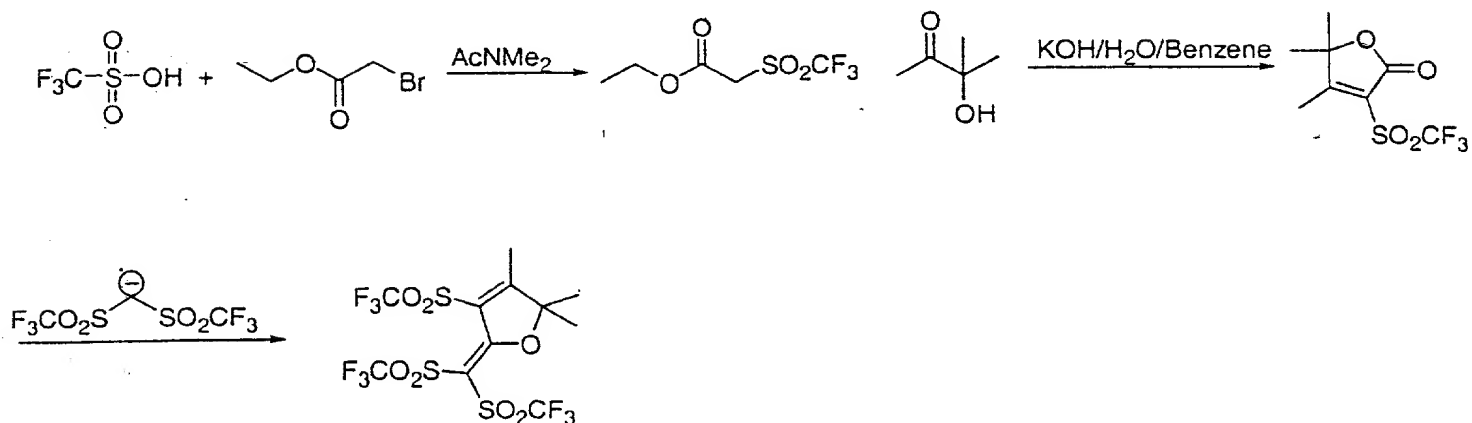


FIGURE 16

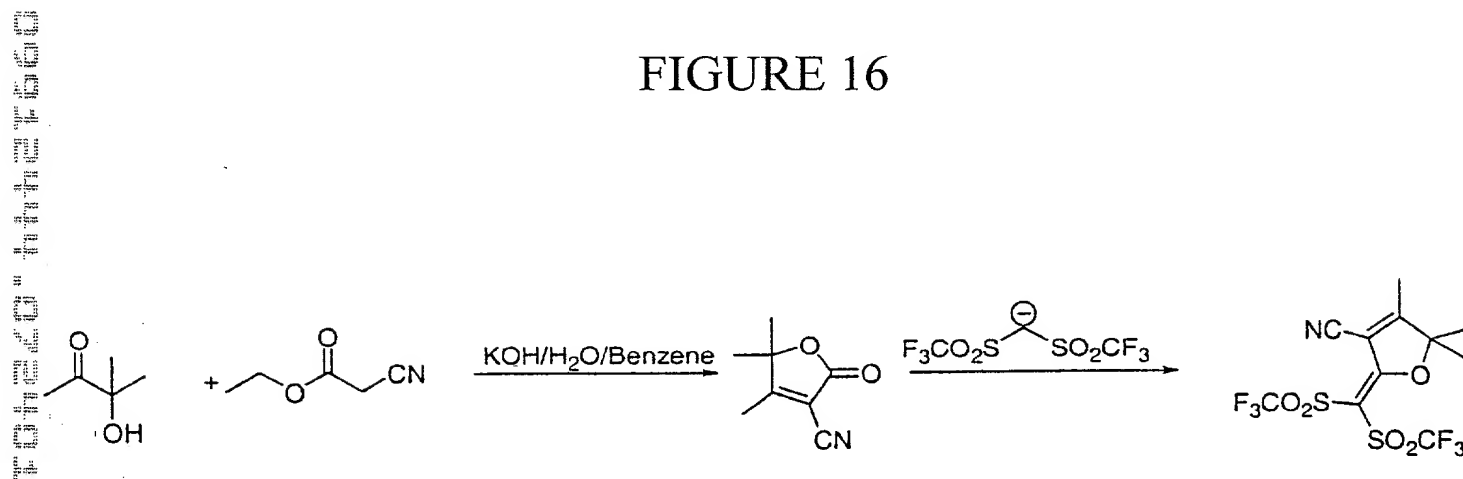


FIGURE 19

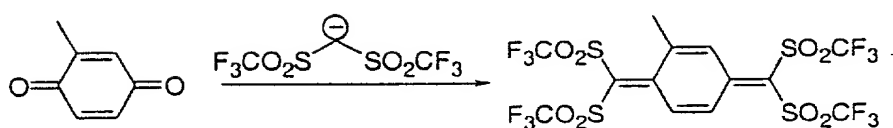


FIGURE 20

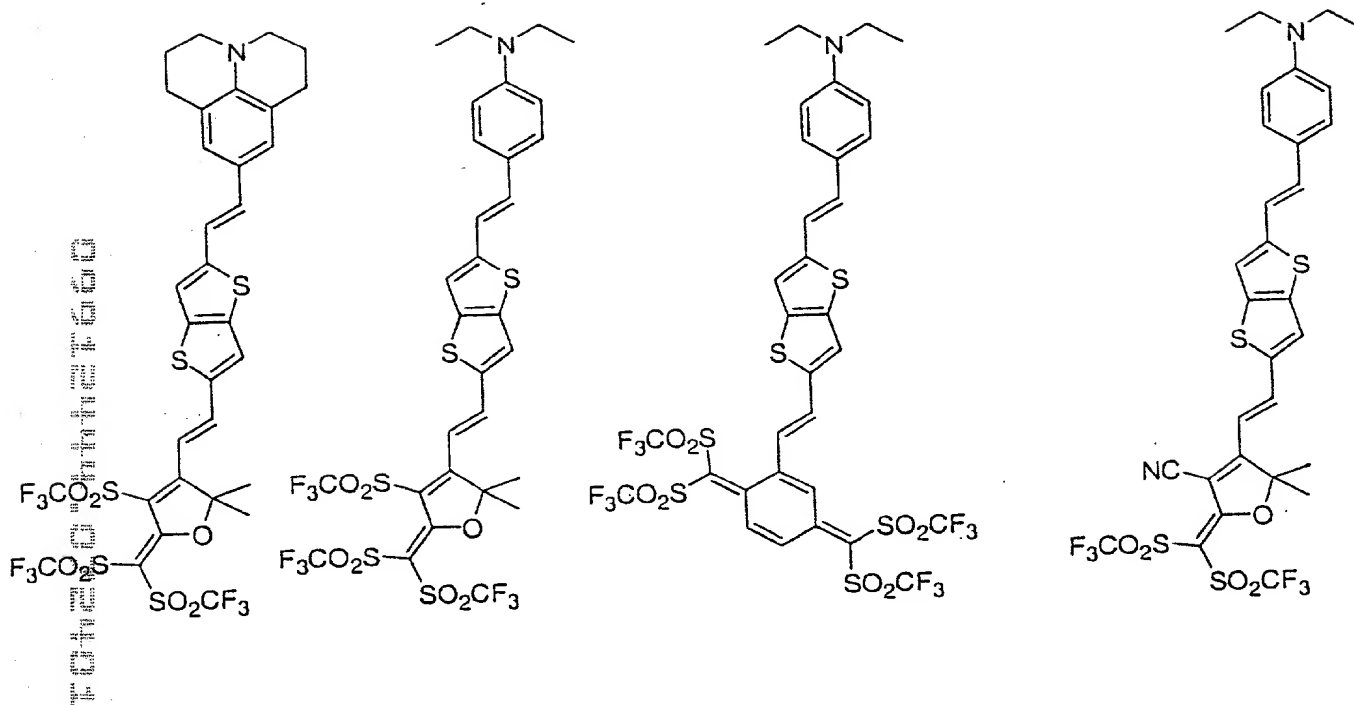


FIGURE 21

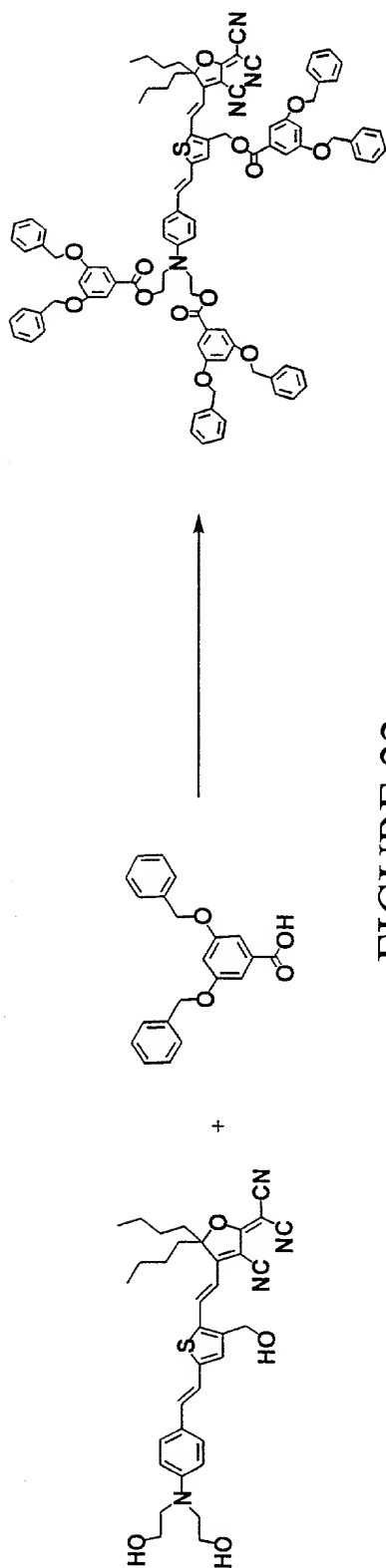


FIGURE 22

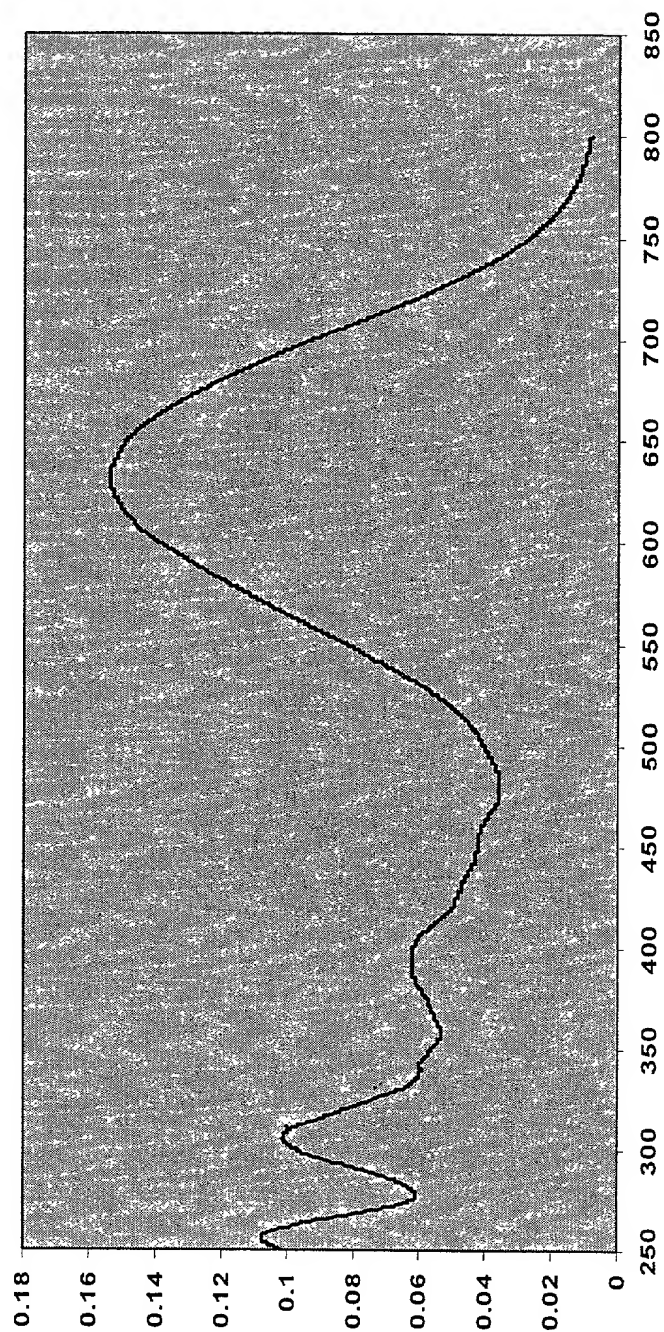


FIGURE 24



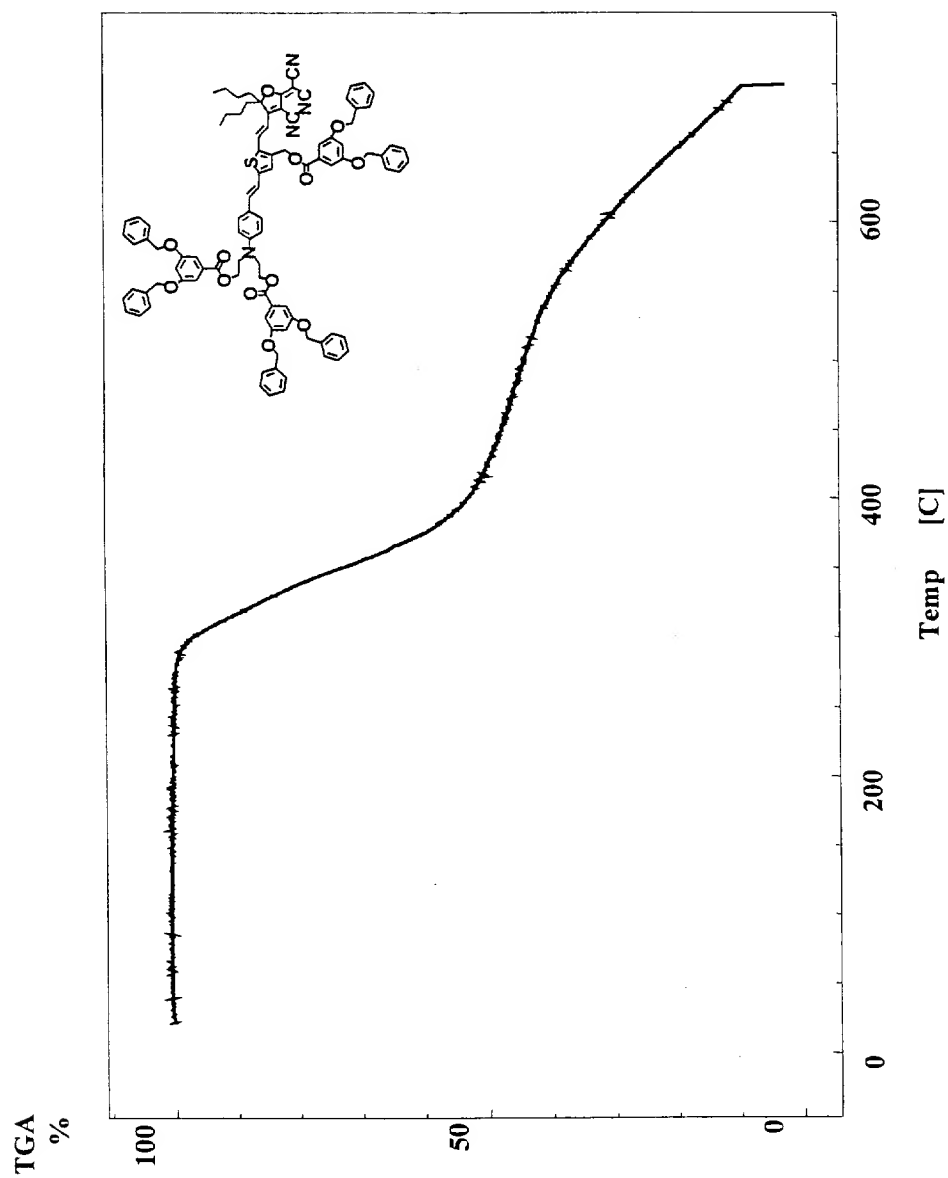


FIGURE 23

### Electro-Optic Activity vs. Loading Density

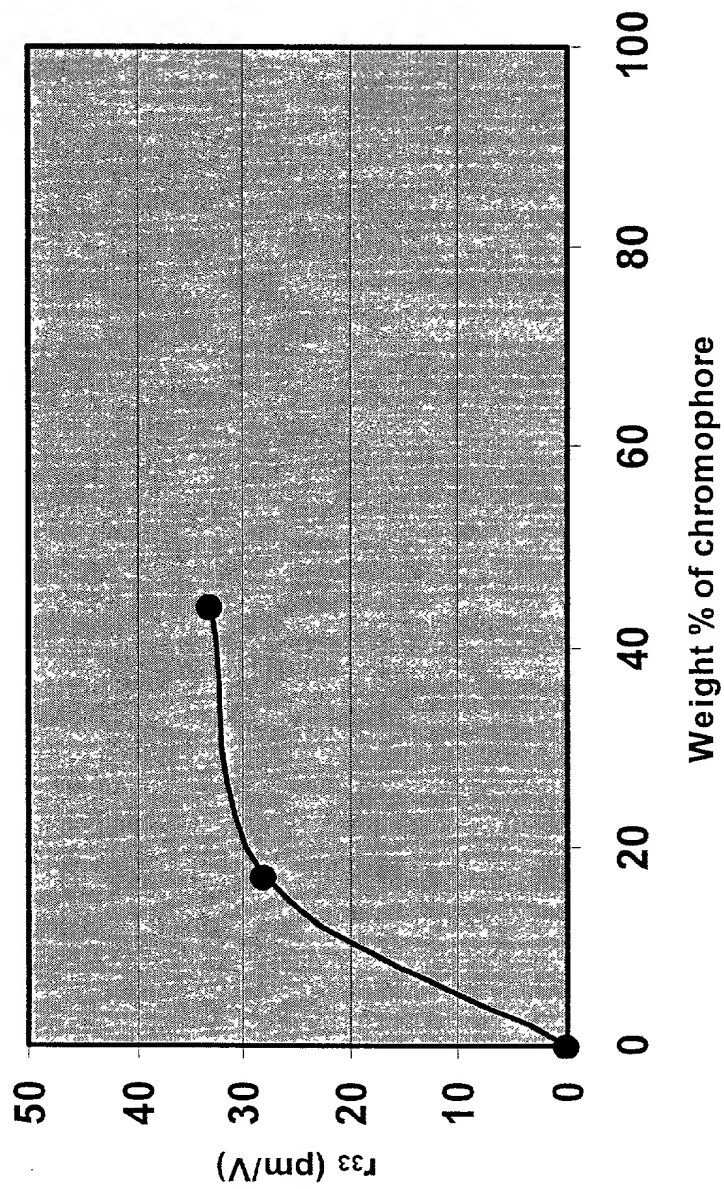


FIGURE 25

COc1ccc(N(c2ccc(OC)cc2)c3ccc(C=Cc4c(s5c(s4)C(=C6C(=C(C(=C6)C#N)C(=O)C(C)(C)C#N6)S5)COCCOc7ccc(OCc8ccc(O)cc8)cc7)cc4)cc3)cc1OC[illegible]

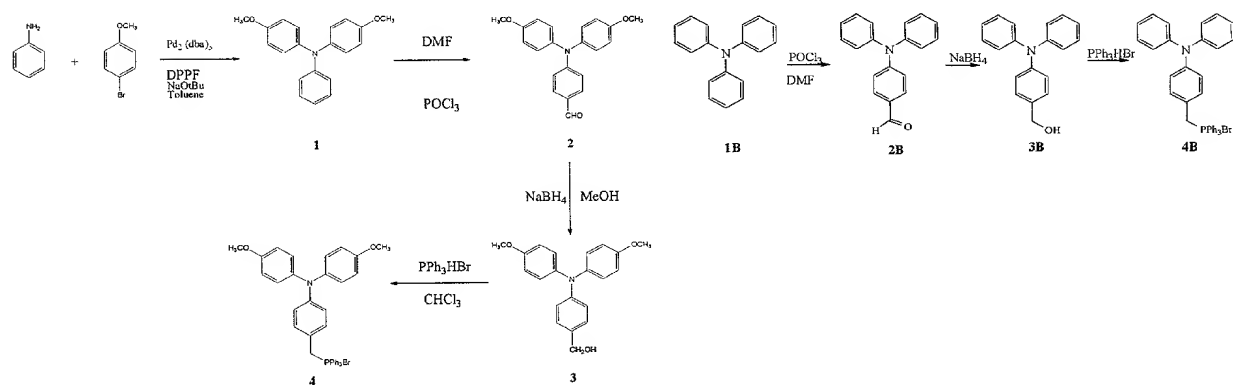


FIGURE 27

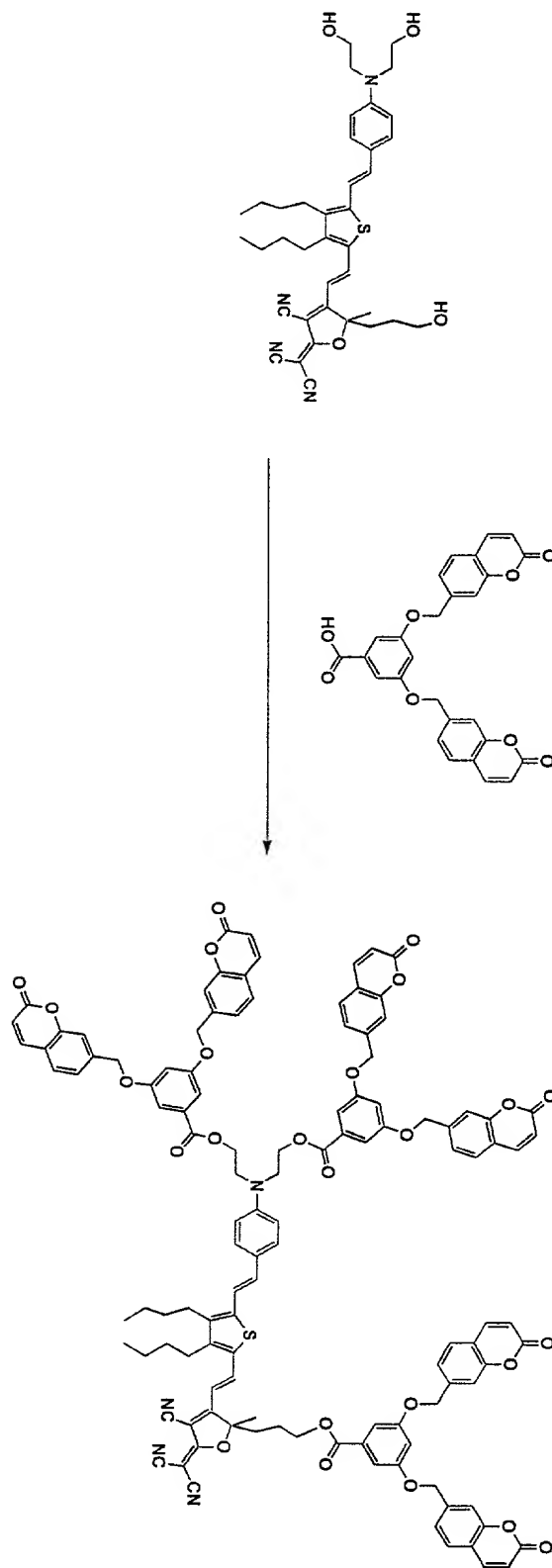
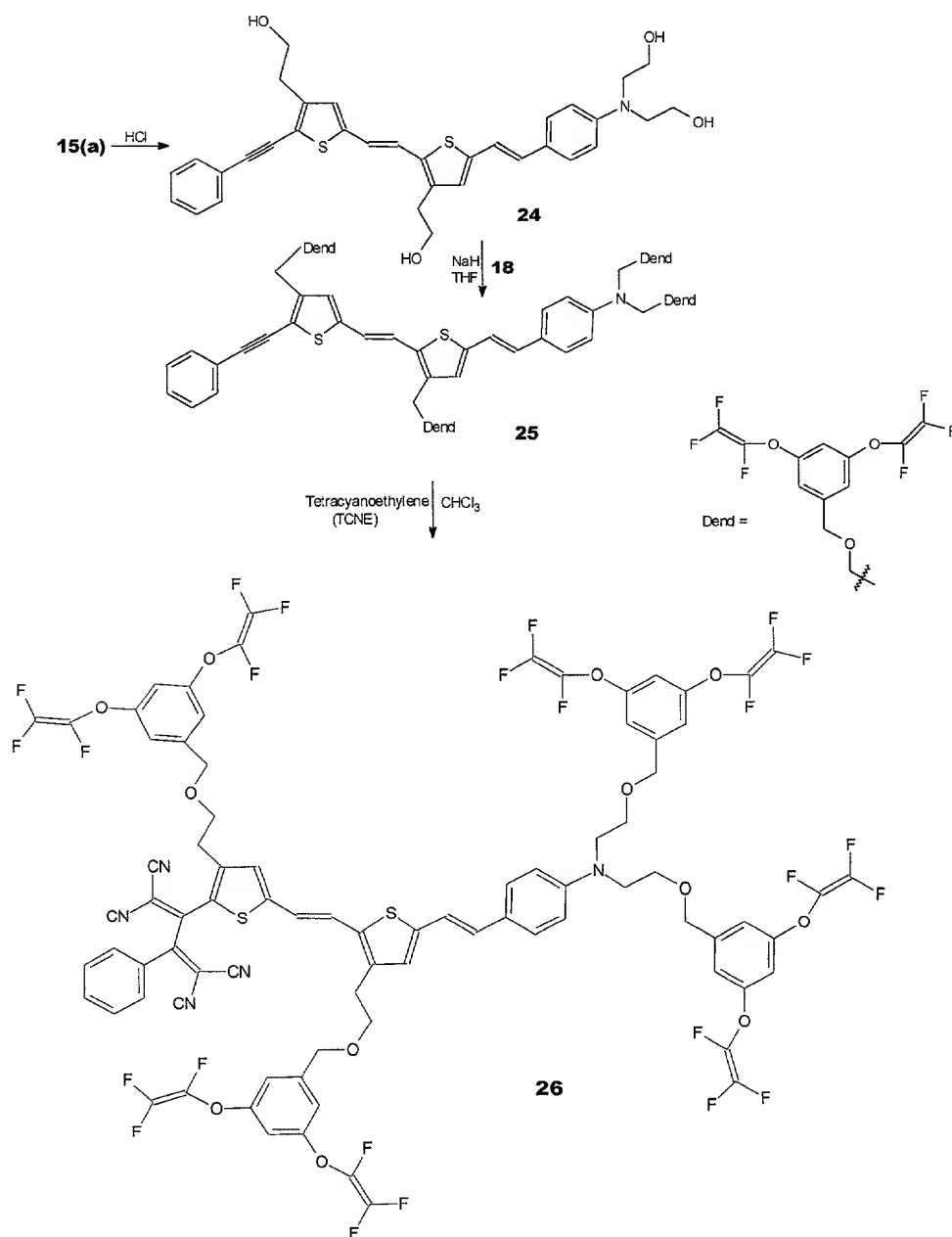
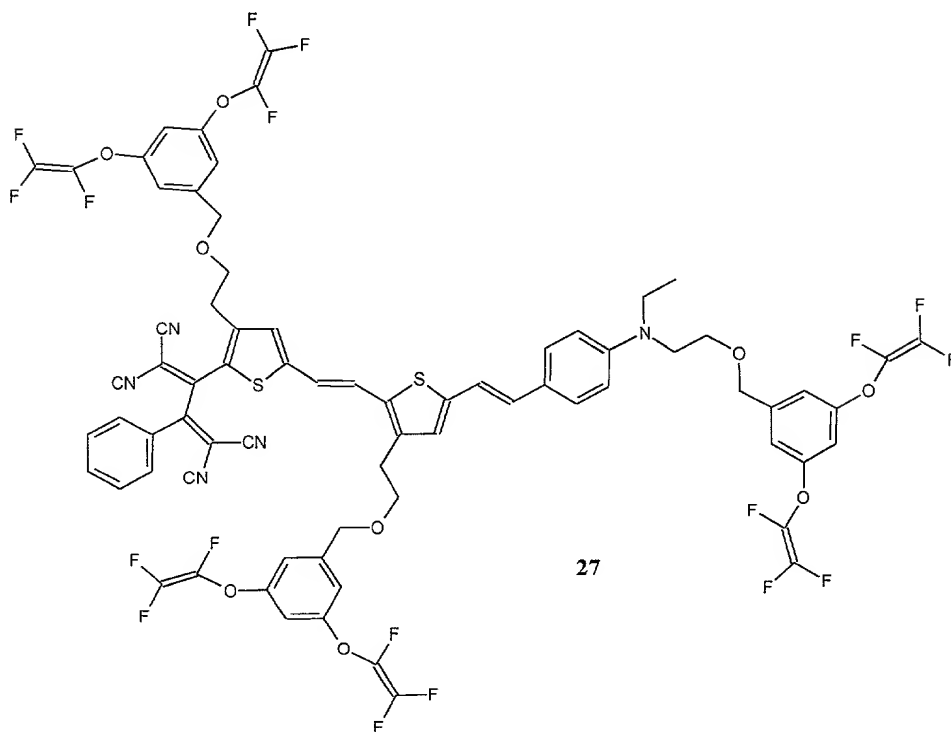
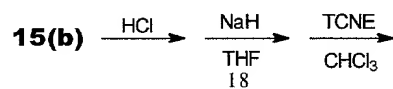
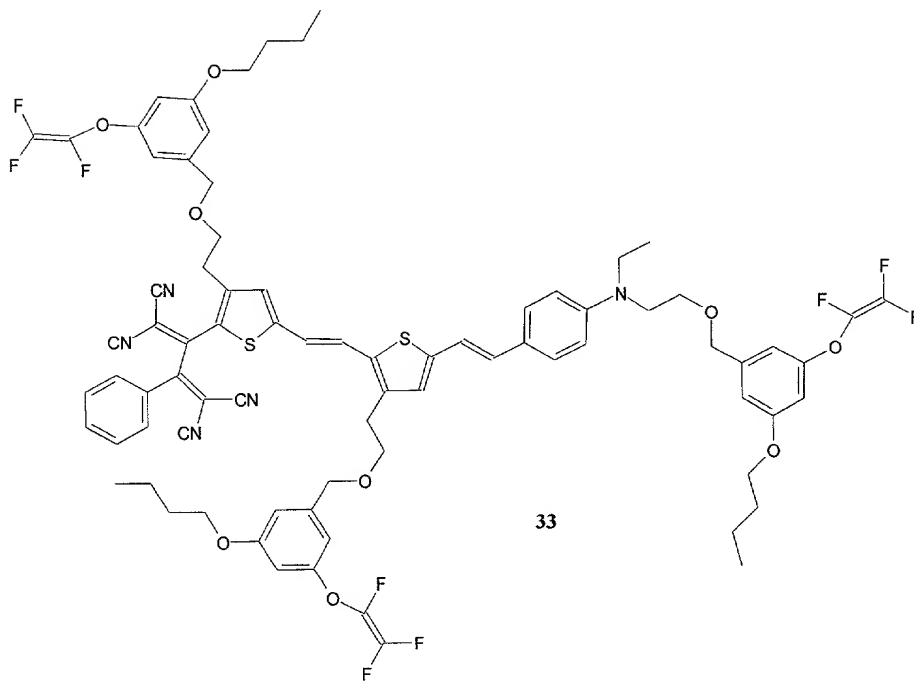
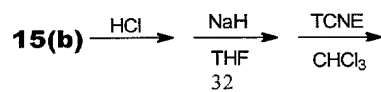


FIGURE 28

**FIGURE 29**

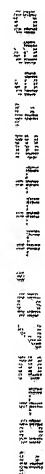


**FIGURE 30**

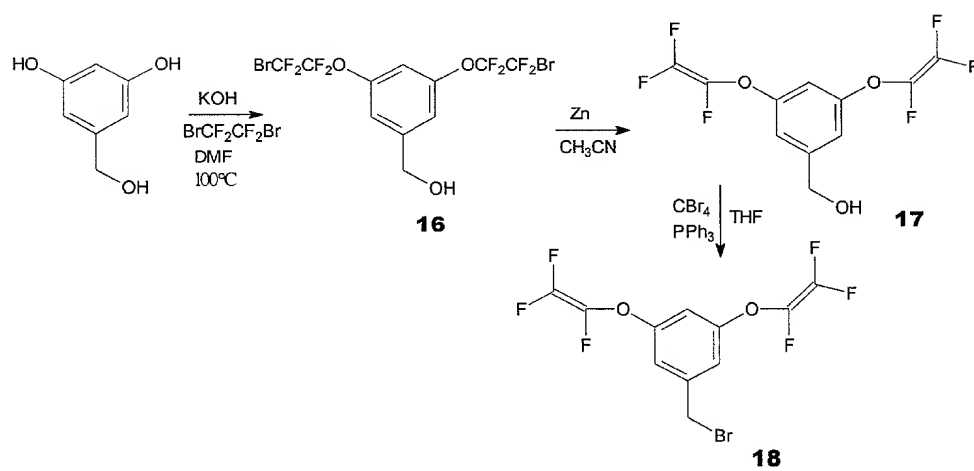


**FIGURE 31**





## FIGURE 32



**FIGURE 33**

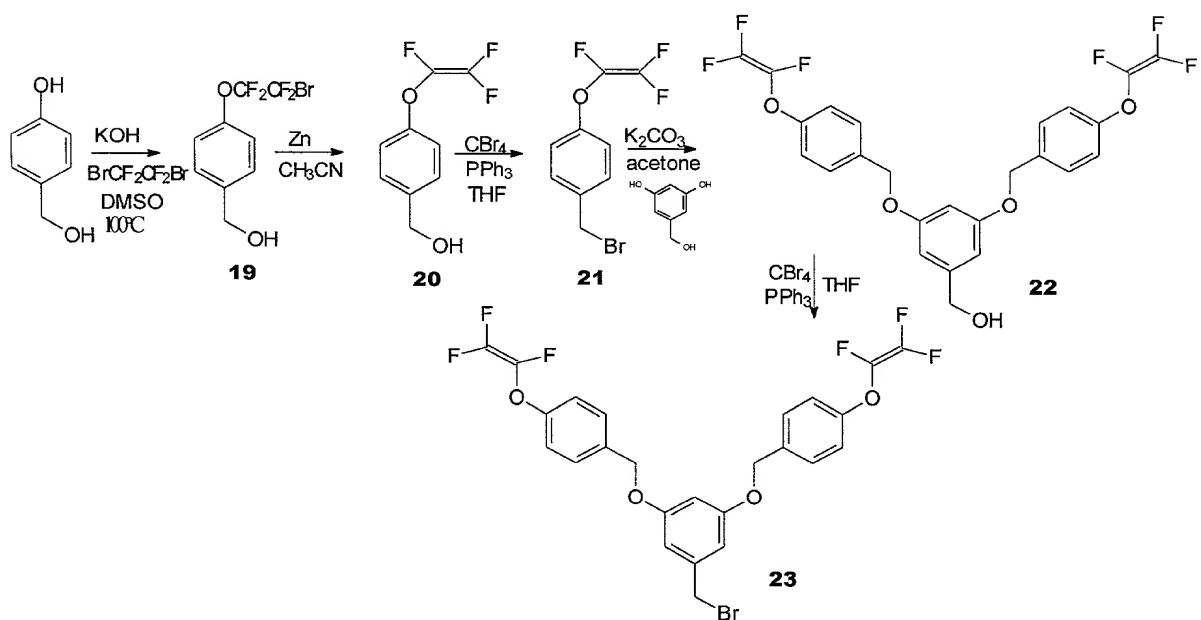
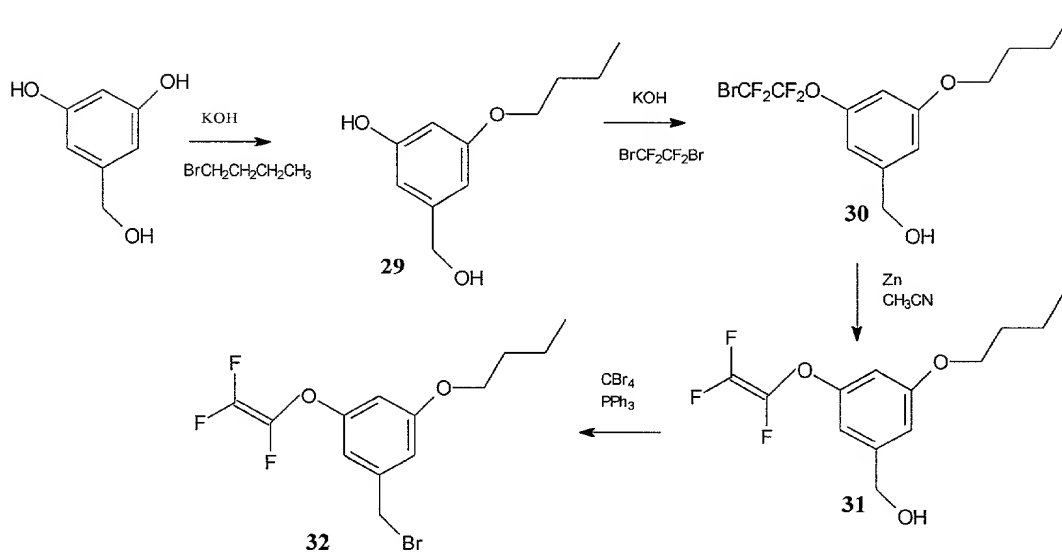
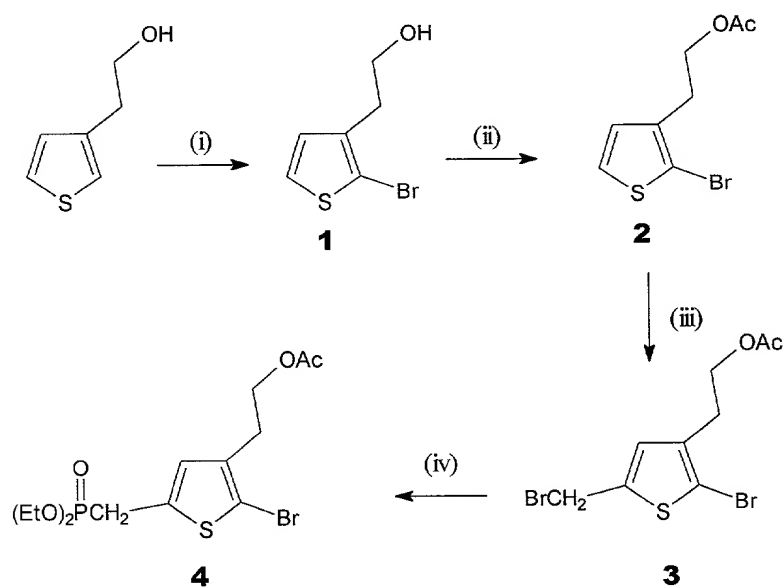


FIGURE 34



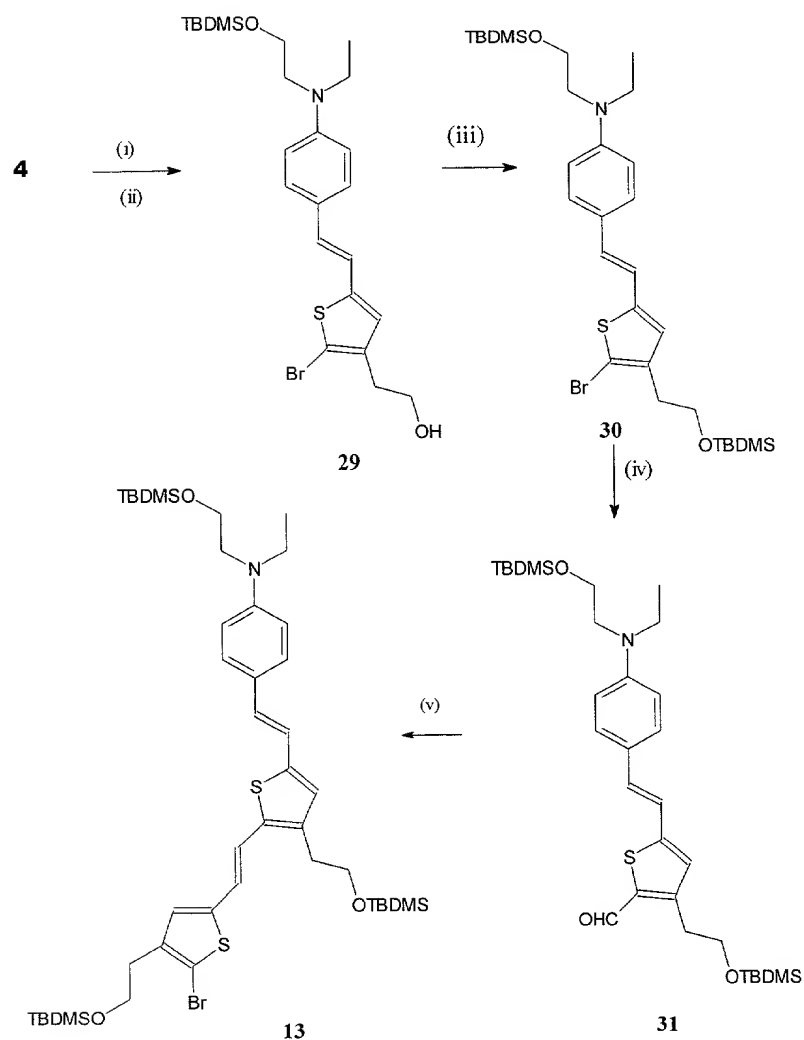
**FIGURE 35**





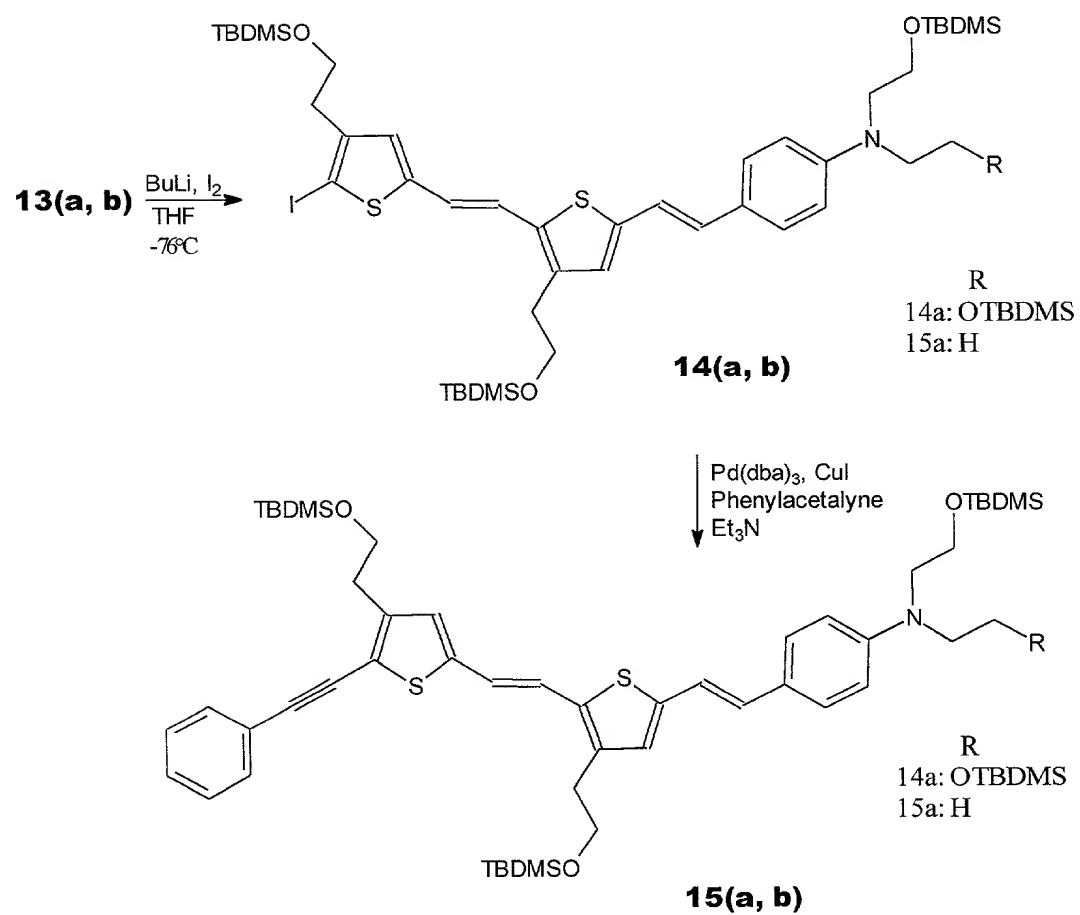
(i) NBS, DMF, RT; (ii) acetic anhydride, 60°C; (iii) (CH<sub>2</sub>O)<sub>n</sub>, 45% HBr/HOAc, HOAc, 50°C;  
(iv) P(OEt)<sub>3</sub>, DMF, 120°C.

**FIGURE 38**



(i) 11, KOtBu, THF, 0°C; (ii) K<sub>2</sub>CO<sub>3</sub>, CH<sub>3</sub>OH, H<sub>2</sub>O, RT; (iii) (CH<sub>3</sub>)<sub>3</sub>CSi(CH<sub>3</sub>)<sub>2</sub>Cl, imidazole, DMF, 50°C; (iv) a. nBu-Li, THF, -78°C; b. DMF, RT; (v) a. 4, KOtBu, THF, 0°C; b. K<sub>2</sub>CO<sub>3</sub>, CH<sub>3</sub>OH, H<sub>2</sub>O, RT; c. (CH<sub>3</sub>)<sub>3</sub>CSi(CH<sub>3</sub>)<sub>2</sub>Cl, imidazole, DMF, 50°C.

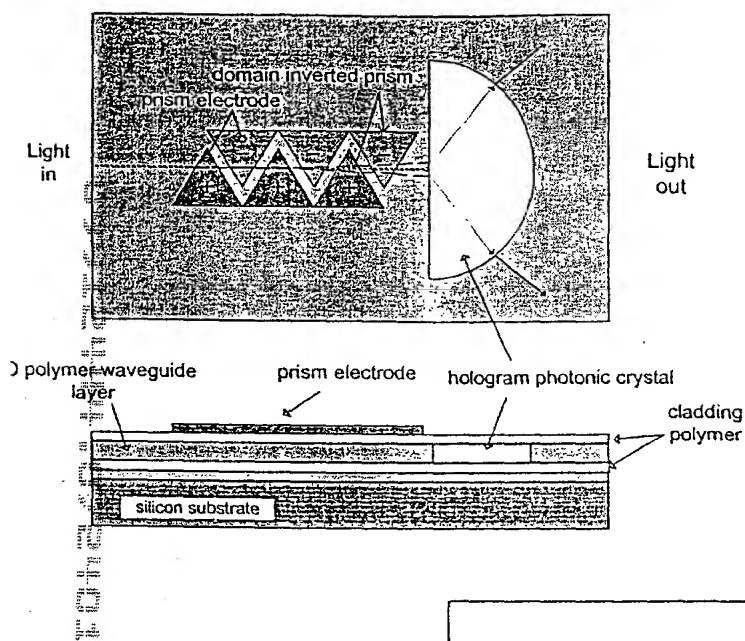
**FIGURE 39**



**FIGURE 40**



# Large Angle Laser Beam Scanner



EO waveguide prism introduces a small deflection angle to initialize the beam scanning. The half-circle 2-D photonic crystal region is imbedded into the waveguide, so that the deflection angle is "amplified" as the light pass through the crystal region. 3D scanning can also be provided if a 3-D structure is built

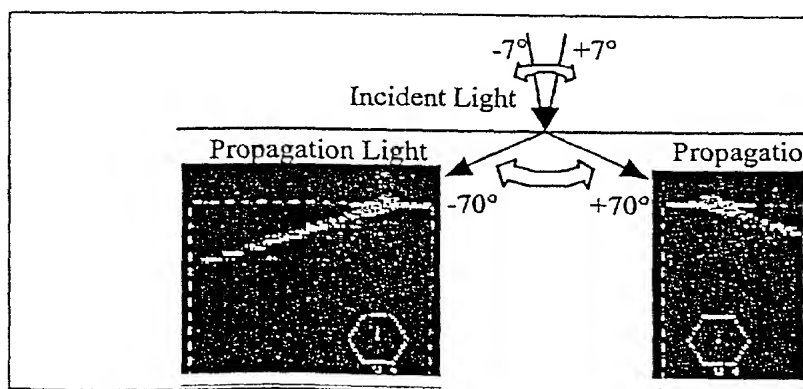
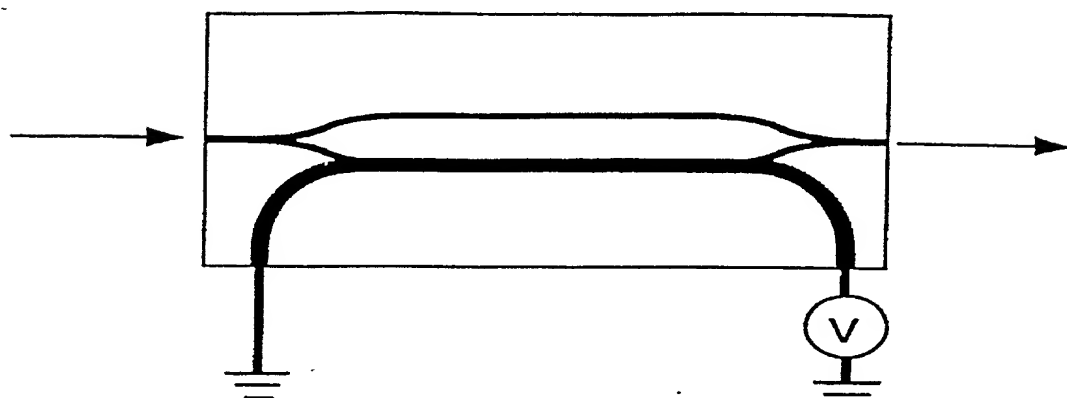
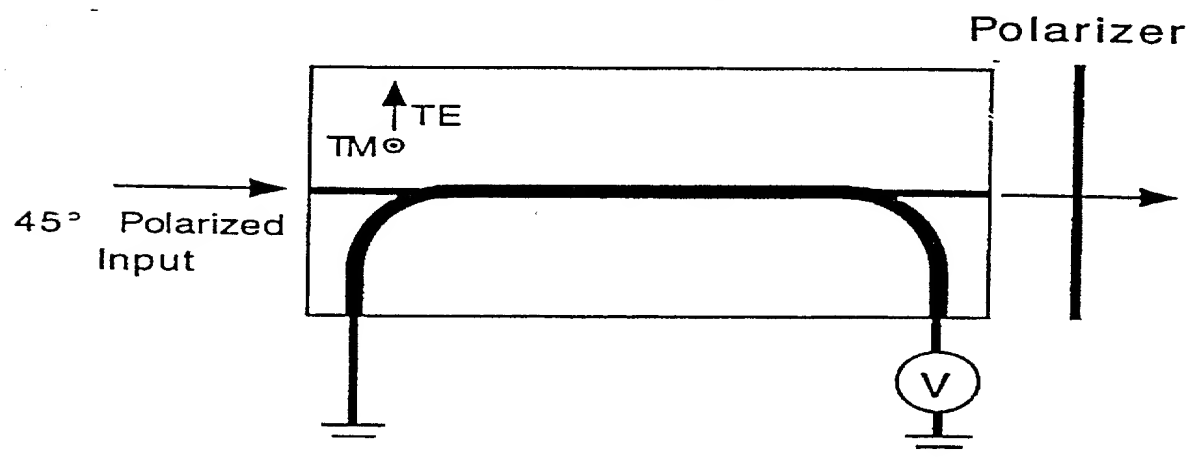


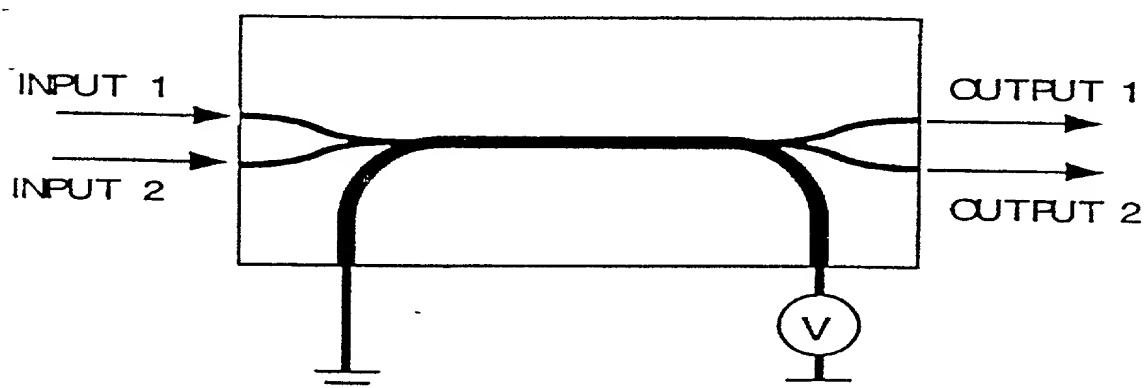
FIGURE 41



Mach Zehnder Modulator

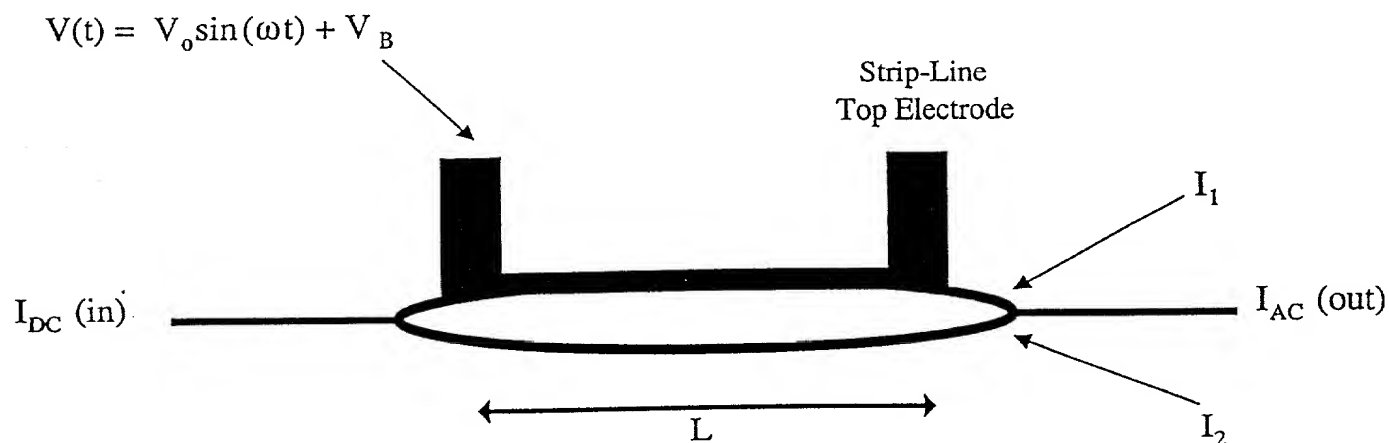


Birefringent Modulator



Directional Coupler

FIGURE 42



$$I_{AC} (out) = I_1 + I_2 + 2(I_1 I_2)^{1/2} \sin(\rho V_o \sin(\omega t))$$

$$\rho = 2\pi r_{33} n^3 L V_o / T \lambda$$

### Comparison of key features of simple devices

	<u>Mach Zehnder Interferometer</u>	<u>Birefringent Modulator</u>	<u>Directional Coupler</u>
$r_{eff}$	$r_{33}$	$r_{33} - r_{13}$	$r_{33}$
$V_\pi$	$V_{\pi MZ}$	$1.5 V_{\pi MZ}$	$1.73 V_{\pi MZ}$
Mod. Power	$P_{MZ}$	$2.75 P_{MZ}$	$3 P_{MZ}$

FIGURE 43

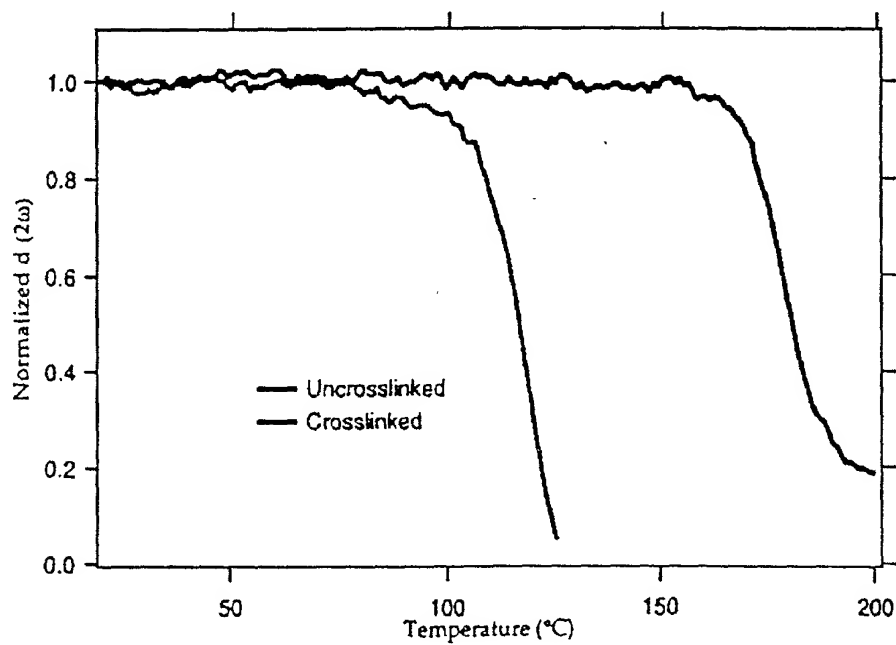
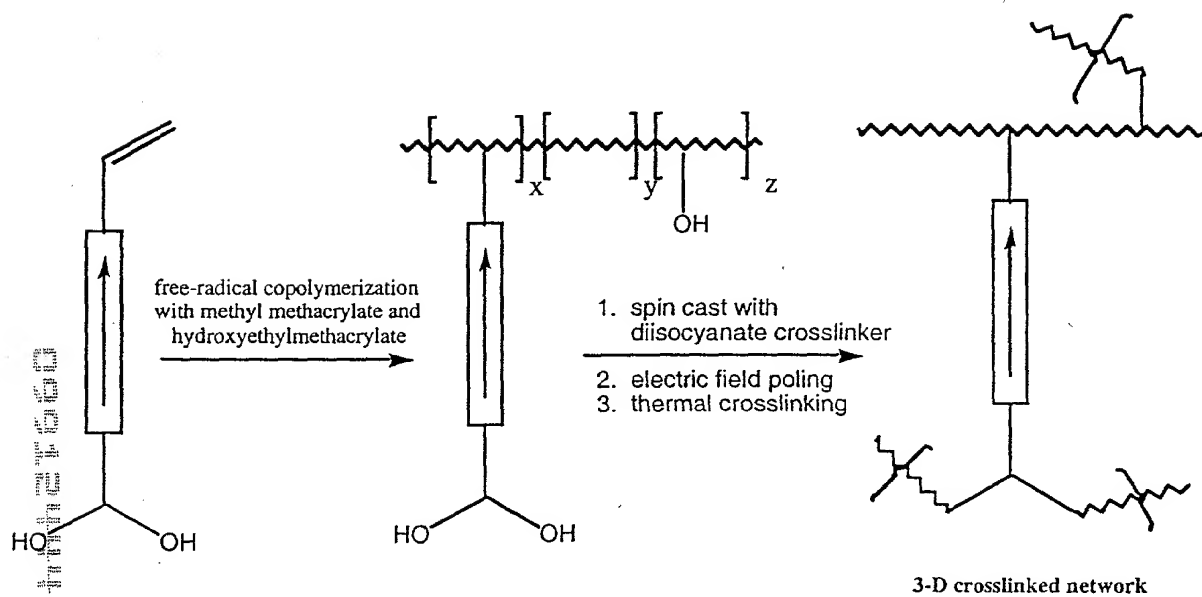


FIGURE 44

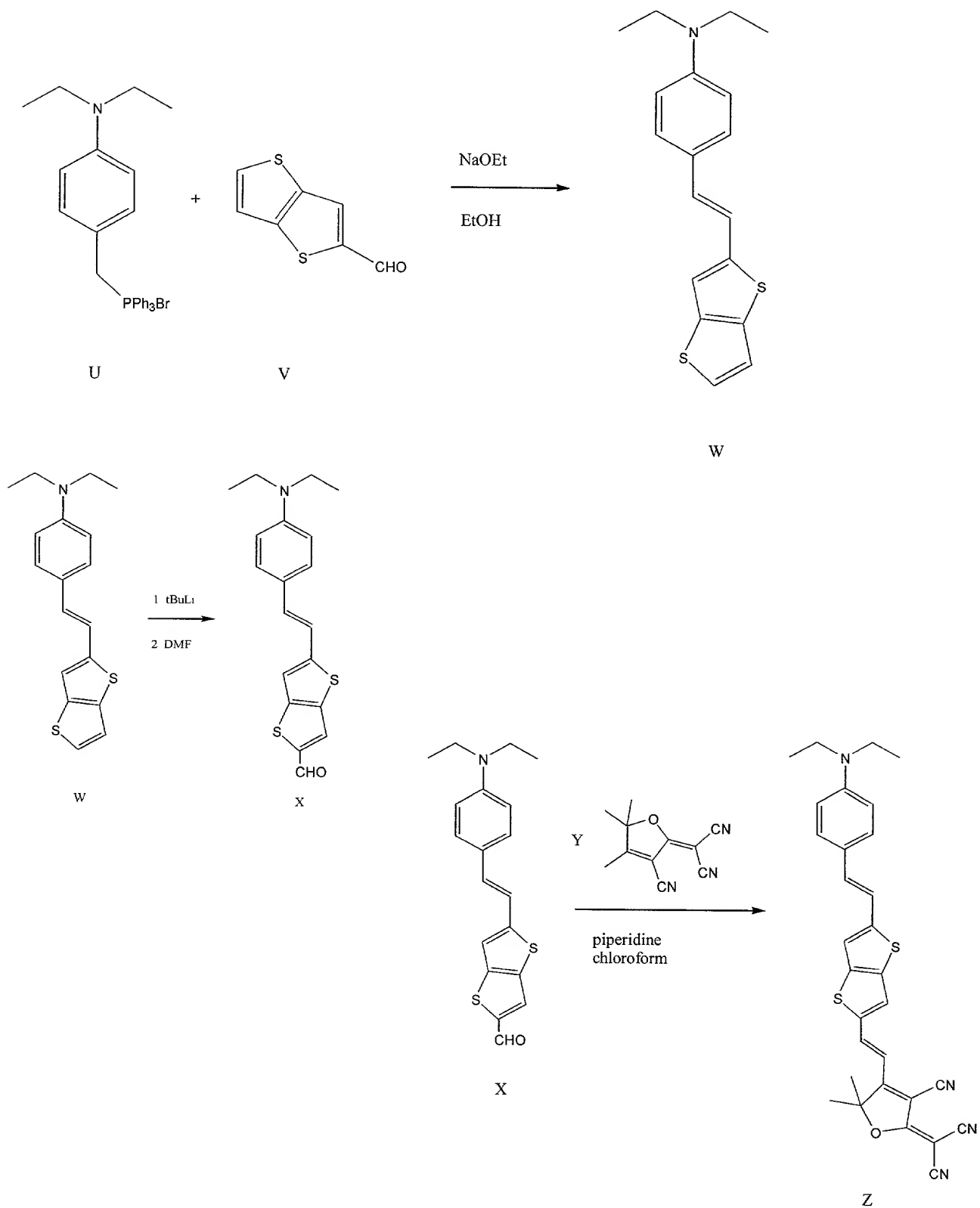
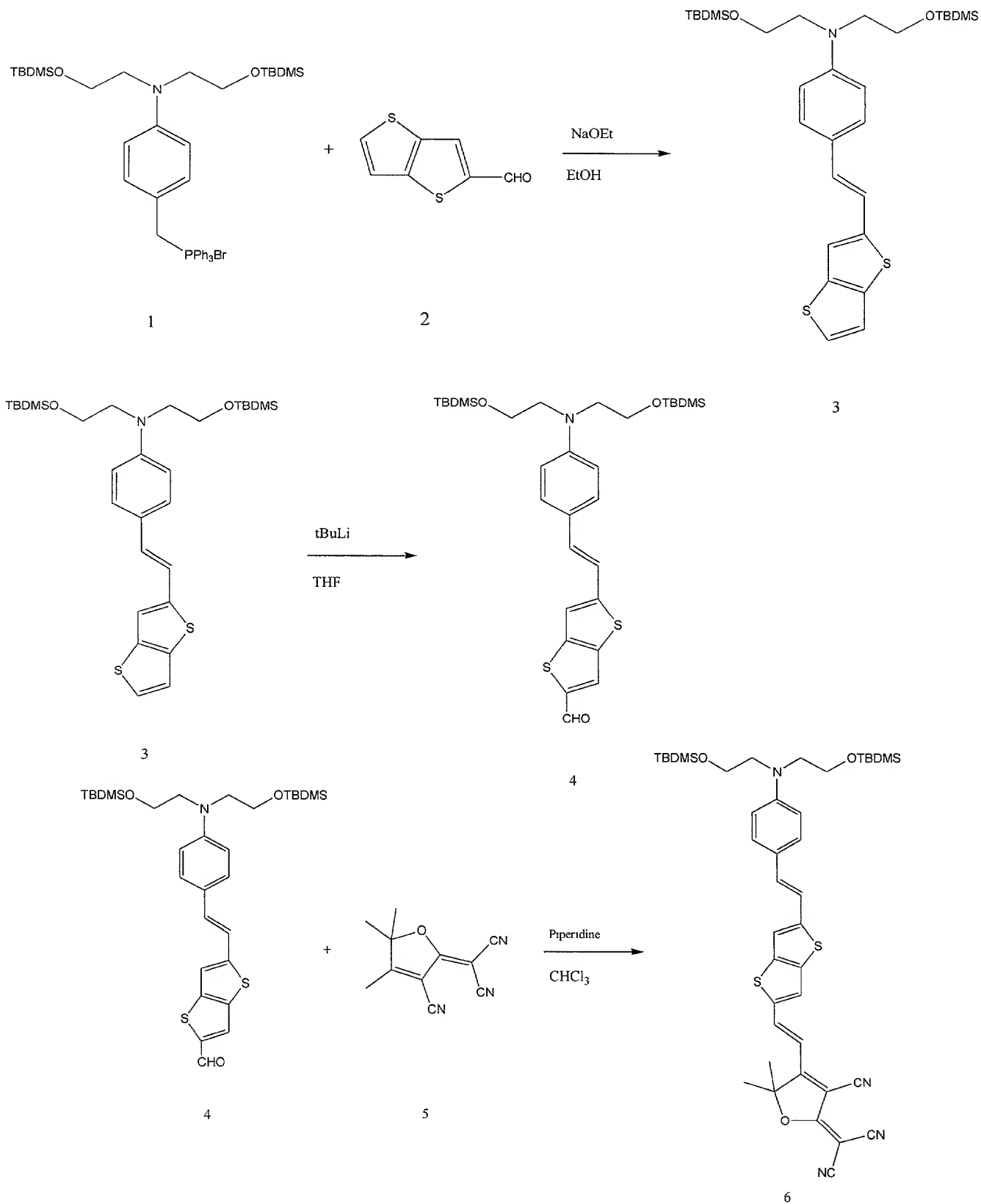
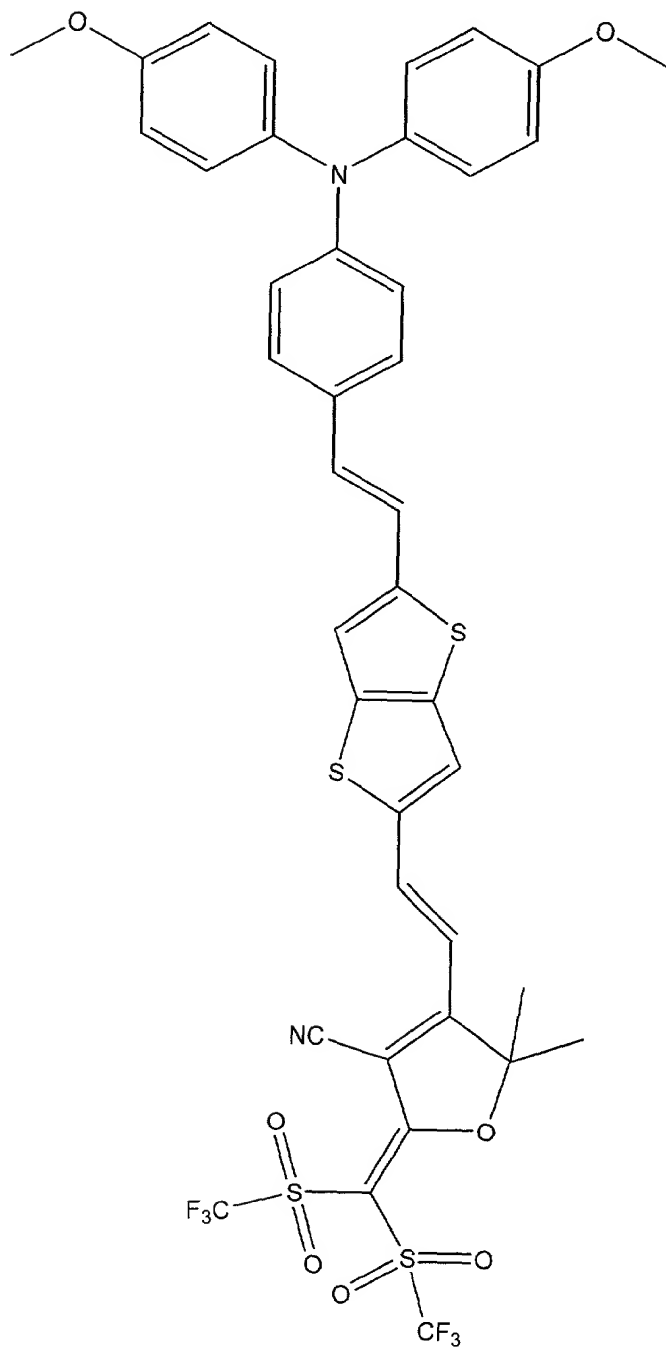


FIGURE 45



**FIGURE 46**



**FIGURE 47**

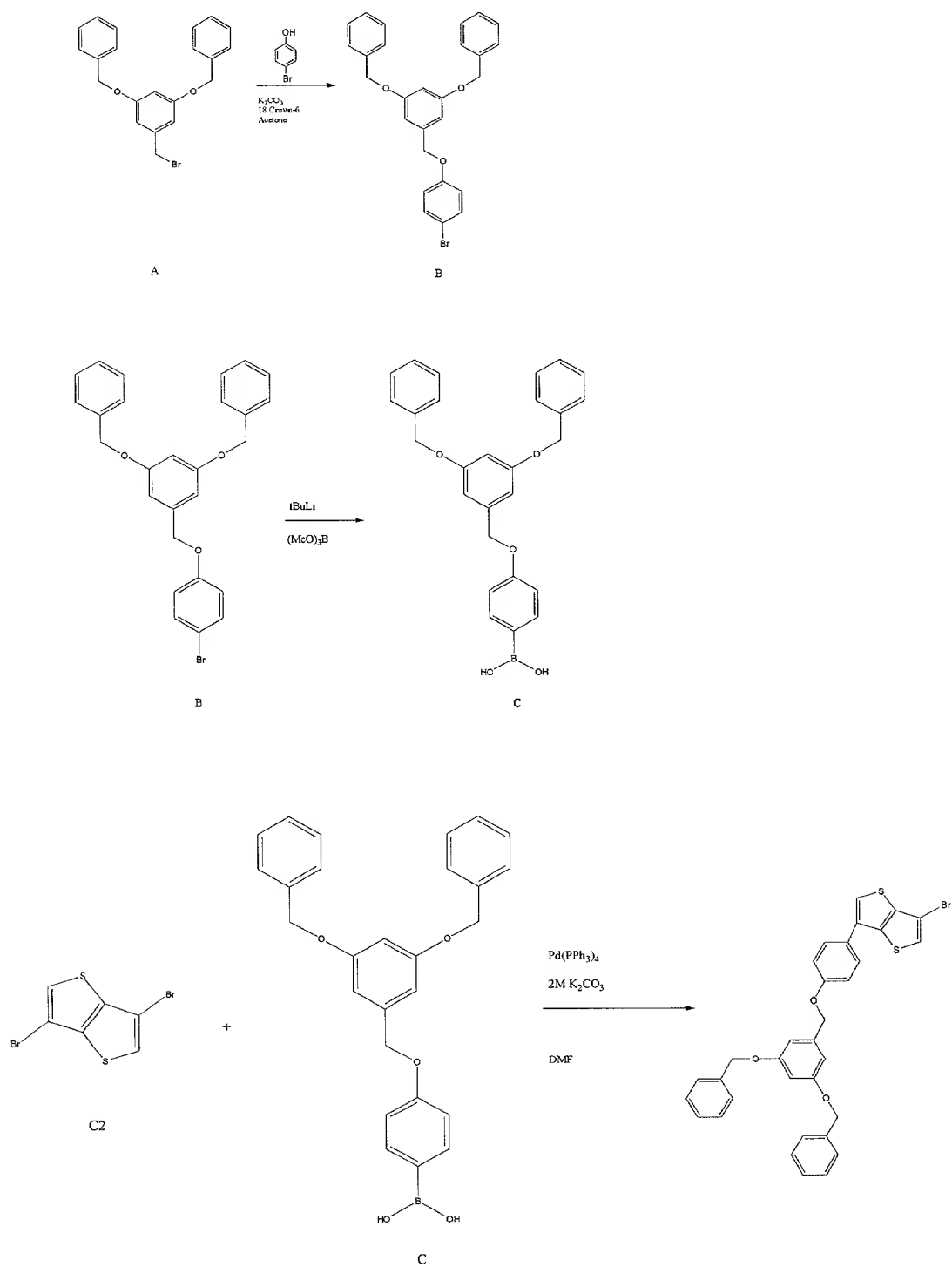


FIGURE 48